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GASTRO-ENTEROPTOSIS

GASTRO-ENTEROPTOSIS

BY

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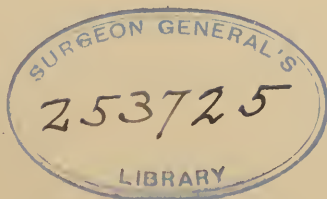
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APPRECIATORY NOTE

It seems to be the fate of many worthy surgical procedures and opinions to be compelled to fight their way through difficulties raised by foolish or unscrupulous advocacy. As we pass in review the large number of new operations introduced during the last two generations, we are amazed to find with what indifference or open hostility many of them, now firmly and rightly established, have been received; and with what eager and thoughtless enthusiasm many were welcomed which are now banished from our work forever. We learn, too, with astonishment how much a reckless advocacy and an intrepid adoption, by surgeons of less judgment than courage, have done to prejudice in the eyes of the cautious practitioner, an operation which at last is found to be of great value.

In consequence of the daring and ingenuity of surgeons, both of America and of Europe, most of the operations, which when newly tried were found to be of great difficulty, are now performed "according to plan," are standardized, and are practiced with little or no variations by surgeons in all parts of the world. To perform an operation has become a fairly simple matter; technical difficulties have almost disappeared. The surgeons greatest task now is to decide in what circumstances an operation should be performed, or avoided, and to safeguard the patient, as far as is humanly possible, from all risks. This facility in the conduct of operations had led sometimes to their performance by surgeons of little skill and of less wisdom, with the result that an operation has perhaps suffered eclipse and become discredited, not for any defects in it as a technical procedure, but in consequence of its improper application to the individual case.

For reasons such as these, the whole subject of visceral prolapse has been discredited in the minds of many physicians and surgeons. It is a subject about which the most confident and tenacious opinions have been expressed after the briefest and most perfunctory experience. Yet it is as difficult a surgical subject from which to unravel the truth as any with which I am familiar. Every one knows the frequency of visceral prolapse, of loose kidneys, of the flaccid abdomen, flat in the epigastrium and bulging over the pubes; and constipation seems the heritage of every race. Here is material in abundance for the surgical adventurer. Regardless of all else, the stomach may be lifted up and fixed by suture, the kidney anchored to the last rib, and constipation for the moment relieved by a short-circuiting or abstracting operation. The lot of the patients is hard. Constipation will soon return, the other kidney will fall down or the anchored one break loose, and the distress of the fixed stomach greatly exceed that felt in its vagrant days.

That is the tale of all reckless surgery. Many surgeons turned away with dislike and distrust from such an unpromising and tainted subject. The action was perhaps a little cowardly, for there are many aspects of the condition worthy of the most anxious investigation; and the happiness of many sufferers depends upon a wise decision being reached as to the methods of their treatment.

I know few subjects in Medicine so greatly in need of the best services that pathologists, physicians and surgeons alike can give; I know of none which requires in the investigator a quicker clinical sense, a shrewder or more deliberate judgment, and a more flawless integrity of utterance.

For these reasons, I welcome the work of Dr. Coffey. All of us who are privileged to know him feel that we can trust him, and can most confidently rely on his honesty and sobriety of decision. He has devoted himself to this most difficult and perplexing subject with cautious enthusiasm; he has regarded it from all sides; he has treated his cases by a variety of methods and has watched them for long periods; he has confessed his early errors with a frankness that convinces us of his perfect sincerity. In this work, he is stating his full case in a manner which will command the respectful attention and admiration of all surgeons. In his hands the subject assumes a dignity and an importance which it has never yet commanded; and through his efforts we are most assuredly drawing nearer to the truth of the matter than we have ever been before.

LEEDS, ENGLAND.

BERKELEY MOYNIHAN

PREFACE

When I received a request from the Editorial Committee on Surgical Monographs of Appleton and Company to write a monograph on gastroenteroptosis, I felt that I had been distinctly complimented. Before signing the contract for the production of the monograph, I began to consult many of my friends over the country, both by word and letter, in order to get their opinion as to the advisability of producing a book of this kind at this time. Almost with one accord, the advice was against it, some thinking the subject was too trivial, others that it was too dangerous. Some even suggested that my reputation was scarcely well enough established to risk it on such an adventure. Finally, I decided to turn for advice to my friend, Sir Berkeley Moynihan of Leeds, who probably has as large a perspective on the surgical problems of the abdomen as any one in the world. While he has always maintained an attitude of benevolent and dignified tolerance on this question, he was the first to recognize my original contribution by including it in the first edition of his *Abdominal Operations*. I have been pleased to note that he has not expunged it from the later editions of his book. In 1920, when I met him in Montreal, among his first words were: "I was speaking with some London surgeons a few days ago. They expressed the opinion that your work on the ptosis question would eventually 'come home to roost.'" He mentioned a number of London surgeons who were working along this line, particularly George Waugh and Tyrrel Gray. His answer to my later request for advice was very positive. He urged me by all means to write the monograph, suggesting that I ignore critics, "for," said he, "they know that in the mountain of rubbish there is a gem of purest truth. There are so many men about these days who seem to consider this a proper subject to drivel over, it is high time that some one, who above all must be a sane man, should burn the rubbish and cherish and preserve the truth." After this encouraging and highly complimentary statement, the contract for the production of the monograph was signed.

From the time of the first operation that I performed for gastroptosis in November, 1901, to November, 1911, a very careful study of all that was done and written on the various phases of this rapidly widening field of investigation was made. During those ten years, my surgical efforts were limited to bedridden patients who were approaching the terminal stages of this condition and were suffering from end results. The work of Lane and Rovsing, in dealing with this class of cases, was particularly outstanding, and so a trip to visit their clinics was made. On this trip, in addition to obtaining their viewpoint, I had the privilege of presenting my views on the

subject to such clinics as those of Lane, Moynihan, Stiles, Rovsing and others. At Moynihan's clinic, I first met George E. Waugh, who showed marked interest in this subject. A few days later, I had the pleasure of attending Mr. Waugh's clinic at the Great Ormond Street Hospital in London. At that time and on other occasions, we discussed this subject. I am very much interested to note that case No. 1 in his long list of colopexies recently reported in the *British Journal of Surgery* was dated May 12, 1912, just four months after our conversation on this subject.

On my return late in February of 1912, my views of the whole subject, along with what I had learned abroad, were presented before the Chicago Gynecological Society, and in October, 1912, were published in *Surgery, Gynecology and Obstetrics* under the title: "The Principles Underlying the Surgical Treatment of Gastro-intestinal Stasis, due to Causes other than Stricture or Ulcerative Conditions."

During these years and during the years of 1912 and 1913, I observed that my medical colleagues were producing very remarkable results by forced feeding, fattening and by certain exercises and orthopedic measures.

By this time, X-ray examination of the gastro-intestinal tract was making unusually interesting revelations in connection with this class of cases as to changes produced by this treatment. This brought into the field of study the very important matter of *the rôle of fat and its relation to intra-abdominal and intravisceral pressure*. A large portion of the years 1912 and 1913 was spent in formulating a conception of the subject of ptosis and stasis. Early in the year 1913, the extraordinary honor of an invitation to deliver the Mütter lecture was tendered me. The lecture was delivered in Philadelphia, December, 1913. My conception of the ptosis question was presented at that time under the title, "Constipation Considered from the Standpoint of Anatomy, Embryology, Physiology and Pathology." The intention was to present the fundamental underlying truths for the consideration of a group of highly trained specialists, both medical and surgical. Owing to the hostile criticism of anything pertaining to this question, by many of the leading men of the country, I decided not to publish the lecture until sentiment had somewhat softened. I believe that time has come, in view of the fact that the most hostile critics must now concede that there is something very important connected with the subject. In this volume, therefore, is published for the first time my complete conception of the question as delivered in the Mütter lecture of 1913, as a basis for the clinical work which has followed and will follow.

No new fundamental principles have developed since the delivery of this lecture. Much clinical work has been done during the intervening nine years by a few individuals in this country and in England. All of the reports are favorable. From these reports by a few men, we are able to add to the former conception of the condition, a more definite clinical conception which is beginning to tell us the meaning of certain symptoms as well as to indicate more clearly the proper form of treatment.

In an experience of more than three hundred and sixty cases treated surgically and more than six times as many treated medically in our clinic, we feel that much has been learned. We may learn much from such articles as that of Waugh in the January, 1920, number of the *British Journal of Surgery*, reporting nearly three hundred cases altogether, and giving his clinical conception of what may be termed "Right-sided Ptosis"; also from Rovsing's many hundreds of cases of what may be termed "Mid-line Ptosis." Besides these, there are numerous other clinics, both medical and surgical, in this country and abroad, which are giving much study to this class of cases.

In formally opening this question, which I feel certain will prove extraordinarily fascinating, I wish to repeat the following warning which was published in my article of 1912: "I concede that in bringing forward this subject of ptosis and stasis, we are opening one of the most dangerous fields for surgical abuses that has ever been opened to the surgical 'confidence man,' who needs no other excuse for performing a surgical operation than the consent of the patient. X-ray observation is of inestimable value in the study of these cases, but is, I concede, the most dangerous agent yet placed at the disposal of the unscrupulous surgeon, because it is so convincing to the laity, and at the same time so meaningless when considered independently of the history of the case, and not properly interpreted." This warning is necessary because of the fact that there are probably more people afflicted with this abnormality than with any other disease known to human-kind, there being probably fully twenty per cent of individuals who are potentially ptotic.

Those of us who have been attempting to promulgate this question have hoped that it would remain in the hands of conservative surgeons with recognized standing, until they could investigate it, in order that the development should proceed from their doors. As far as I have been able to observe, the investigation by conservative surgeons has not been very thorough. Fortunately, truth will not be ignored. This question will, I believe now, be passed on to the rising generation of surgeons for further development and final settlement.

The purpose of this book is to assemble the most important facts that are known pertaining to the question and to coördinate them into a conception on which a clinical structure for the years to come may be built.

Men of recognized ability and vision have been earnestly working on this question for a generation.

Nearly a half century ago, S. Weir Mitchell, although working empirically, successfully coped with this question as it presented itself under the disguise of "neurasthenia." The fact that he thought that by forced feeding and fattening he was padding the nerves instead of the gastro-intestinal tube did not materially lessen the importance of his clinical accomplishment.

Glenard, in the late eighties, believed this question was one of metabolism and that it was primarily an obscure liver disease.

Rovsing has taken a mechanistic view and has limited his activities chiefly to those organs which cross the midline and believes they are practically all due to the wearing of corsets or to childbearing. His treatment was purely mechanistic, consisting of firm fixation of the stomach to the abdominal wall.

Lane has taught us most of what we know of the end results of stasis and of the nature of the acquired bands found in the abdomen. His law of the crystallization of the lines of force is probably the most important observation that has been made in connection with this subject. He failed, however, to recognize the importance of the normal prenatal fixations of certain abdominal organs and that deficient prenatal fixation was the underlying cause of much of the membranous development. He, therefore, considered it necessary to do very radical surgery as a therapeutic measure.

Longyear discovered extraperitoneal fibrous tissue fastening a prolapsed colon to a movable kidney, which he classified as a ligament, but which in reality probably represented extraperitoneal crystallized lines of force laid down in accordance with Lane's law. He made the important discovery that the kidney is probably pulled out of position by the weight of a movable colon acting through this fibrous tissue which he called the "nephrocolic ligament." Elevation of these organs and bringing this fibrous tissue, holding the colon and kidney together, out through the fascia and fastening it relieved the whole chain of symptoms in many cases. Longyear, fixing his attention on this one structure, attempted to make it the pivotal and fundamental consideration of the entire ptosis question.

Richard Smith observed the frail structure of ptotic patients and made valuable records.

Goldthwait and Franklin Martin believed that the abnormal body conformation produced most of the ills of these unfortunate and misshapen individuals, and they have devoted their energies to correcting these deformities. Goldthwait, however, very early discovered the relation between deficient prenatal fixation of the colon and general ptosis.

Klose was among the earliest to discover that deficient peritoneal fixation of the ascending colon was a very fundamental consideration in connection with this subject and, as early as 1907, fixed the cecum and ascending colon.

Wilms, Waugh and others have assumed that a mobile cecum is the fundamental anatomical condition which is responsible for the ills of the entire ptosis question. Accordingly, their therapy consisted in firm fixation of the cecum.

Jackson, Walton and others have concentrated most of their attention on the secondary membranes found in the neighborhood of the cecum and have cut the membranes.

Klemm, Blake and others believed that the dilated cecum was the most outstanding feature connected with the subject. Therefore, they plicated the cecum.

Wilkie, Kellogg, Codman and others believe that duodenal arteriomesen-

teric ileus is probably the most important pathology connected with the ptosis question.

Homans, Taylor and others believe that bands in the neighborhood of the duodenum and gall-bladder constitute a real cause of much abdominal distress.

Anatomists, basing their conclusions on postmortem examinations held on the cadavers of newborn babes, have noted the frequent occurrence of membranes and peritoneal folds at the beginning and ending of the fused peritoneal areas and gravely announce that all membranes and bands found in the abdomen are congenital. Lane is equally positive that they are all acquired. The everyday practical surgeon, seeing the results of acute inflammatory conditions, believes they are all inflammatory. The casual observer, seeing this apparent difference of opinion, dismisses the entire subject as being mythical and unworthy of the attention of a strong-minded individual.

As a matter of fact, all the observations enumerated in the above list may be verified by any abdominal surgeon who will carefully observe the structures in the abdomens of a large number of patients. He is unable to harmonize them because each enthusiast treats indifferently the observations of all the others.

If this book has clearly brought together the teaching of all these men of genius into a harmonious workable conception of the ptosis question, it will have fulfilled its mission.

I believe a careful study of this subject will convince one that the real reason for the apparent differences of viewpoint on this subject is that it is so far-reaching in its ramifications. Each of the above-mentioned authors has taken up a phase of the subject and worked it out and expressed it more thoroughly than a casual observer could do. In order to include the exact viewpoint of these original workers, I have, where possible, sought permission to quote the exact words of the author even to the extent of several pages. For this privilege I am deeply grateful to the authors and publishers. I am especially grateful to John Wright and Sons, Ltd., Publishers of the *British Journal of Surgery*, and to the following authors whose articles have been published therein: Albert J. Walton, Sir Arthur Keith, Sir William Arbuthnot Lane, N. Mutch, A. E. Barclay, George E. Waugh, D. P. D. Wilkie. Also to Sir Berkeley Moynihan for his comprehensive and more than kind introduction.

In presenting this book, I wish to thank Miss Gertrude Gray and Miss Maud Spacht for assembling the clinical records and literature for study and for typing the manuscript. I cannot fail to express my thanks and deep appreciation to Mr. Frank C. Trahar, who has produced all my illustrations on all subjects for the past twenty-one years, and whose brilliant mind, clear conception, genuine loyalty and helpful sympathy have meant far more to me than the mere making of pictures.

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GASTRO-ENTEROPTOSIS

GASTRO-ENTEROPTOSIS

CHAPTER I

STRUCTURE OF THE ABDOMINAL WALL

We have been accustomed to look upon the wall encompassing the abdominal cavity as a very elastic structure. This is far from the truth, as will be shown by the study of anatomy. In the first place, more than one half of

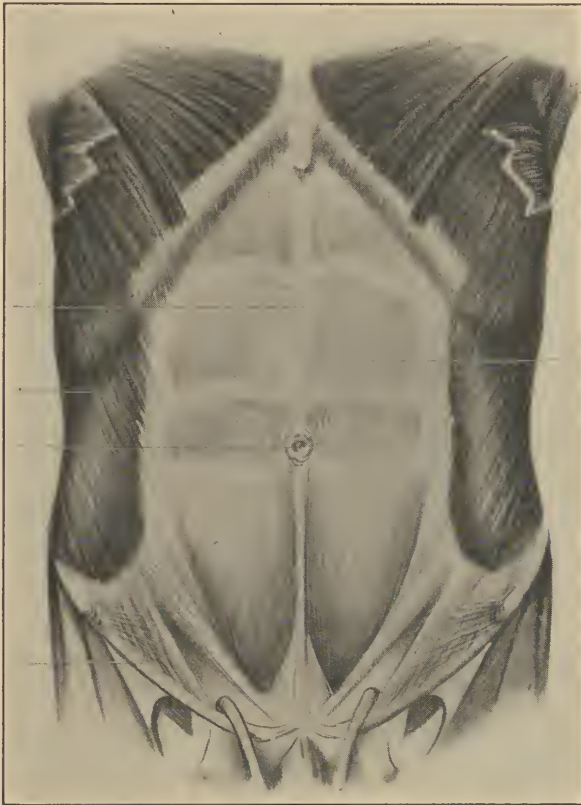


FIG. 1.—STRONG WHITE FASCIA OF THE FRONT ABDOMINAL WALL. (Modified from Toldt.)

this wall contains bony structures. Some of the most important abdominal organs, including the liver, spleen, duodenum, stomach and kidneys, are almost entirely within the bony abdominal walls. The pelvis is chiefly surrounded by bony structures, particularly in the back. For four inches in the back, the

spine makes a wall entirely inelastic. The eight inches of the center of the abdomen, which extends from the pubes to the arch of the ribs, is firm and inelastic, made so by the two layers of aponeurosis surrounding the recti muscles. From the point of fusion of these two layers of fascia at the linea semilunaris, there are other layers of fascia which surround the lateral muscles and fuse in the back to form the lumbar fascia, which is inelastic.

Therefore for all practical purposes, we may state that the peripheral abdominal wall is a flexible structure, composed chiefly of flexible and elastic muscle inclosed in a flexible but nonelastic aponeurosis. While the wall is flexible to a large degree, it is collapsible only in its front portion. Except in chronic processes, such as the development of a tumor by cellular increase, the

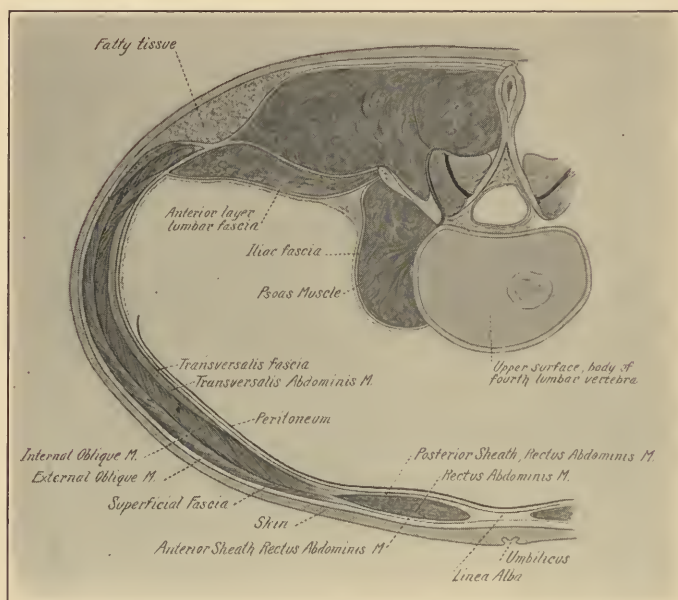


FIG. 2.—CROSS-SECTION OF THE ABDOMINAL WALL. (Toldt.)

Picture taken at its most flexible part—the upper surface of the fourth lumbar vertebrae. This shows the strong fascia which limits elasticity.

development of a cyst, or ascites, which has behind it the contrant blood-pressure, or the development of pregnancy, there is but little change in the capacity of the abdomen of an otherwise normal person. Extreme distention of the abdomen may seemingly enlarge the abdominal cavity by pushing up the diaphragm at the expense of chest capacity. By elevation of the ribs, the girth of the upper portion of the abdomen will be increased, but the lower portion will be correspondingly diminished. Elevation of the ribs plus extreme distention of the abdomen makes tense the collapsible part of the abdominal wall and increases the girth of the abdomen at all points, but the only actual increase of abdominal capacity is made at the expense of chest capacity by elevation of the diaphragm (Figs. 1 and 2).

CHAPTER II

SHAPE OF THE ABDOMINAL CAVITY

The shape of the abdominal cavity is wonderfully adapted to the holding of its contained organs with the least possible friction or effort. Many who have written on ptosis have failed to give proper credit to this point. We shall, therefore, go into details.

The exact shape of the abdominal cavity was determined as follows: The body of a man who had died of pneumonia was used. The weight of the man

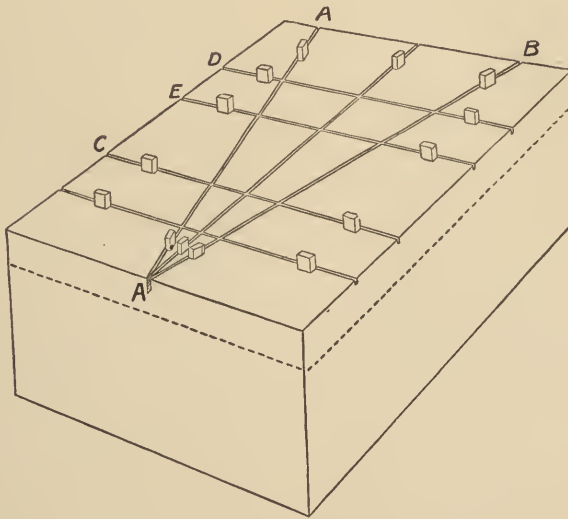


FIG. 3.—PLASTER BLOCK CONTAINING CAST OF ABDOMEN.

A-A, line drawn through appendix from center of perineum to point of shoulder. *A-B*, corresponding line on left side. (Sections along these lines represented in Figs. 4 and 5.) *C*, section through appendix shown in Fig. 8. *E*, section lower pole of kidney represented in Fig. 7.

was about one hundred and forty pounds; height five feet, eight inches. The table on which the body lay was leveled. The front of the abdominal wall was removed. The stomach and all the intestines except the base of the cecum and the appendix were removed. The liver, gall-bladder, kidneys, ureter and bladder were left and a string was pinned along the course of the ureter so as to make it prominent in the plaster cast. The body was made perfectly level. The cavity was filled with liquid plaster of Paris. Two days later the body was cut off from the cast. The cast was then dried and painted with iodine to give it color, and was covered with several coats of shellac to make a

line of cleavage. The flat, or abdominal, side of the cast was placed on the bottom of a box so that the highest point of the cast represented the deepest point in the flank. An inch of liquid plaster was poured in around the cast, at which time the stakes shown in Fig. 3 were set to mark the lines for sawing, after the cast had dried. On the right side a line (A) was made which would pass through the deepest point of the flank, the appendix, and the deepest part of the pelvis. This line would correspond to a line drawn from the center of the perineum to the tip of the shoulder. A corresponding line

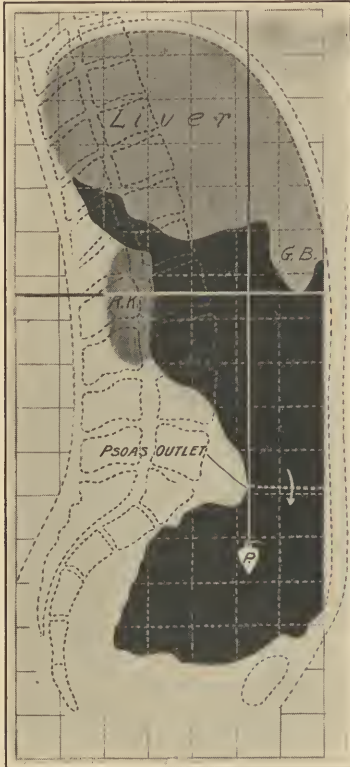


FIG. 4.—ANTEROPOSTERIOR SECTION THROUGH PELVIS, APPENDIX AND RIGHT FLANK. Plumb line represents perpendicular psoas line.

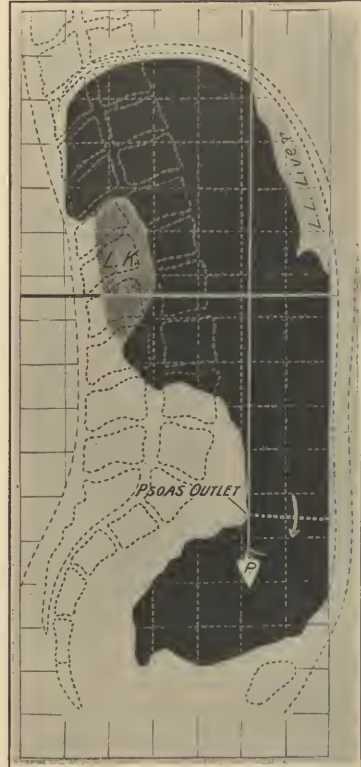


FIG. 5.—ANTEROPOSTERIOR SECTION THROUGH PELVIS, PSOAS MUSCLE AND LEFT FLANK. Plumb line represents perpendicular psoas line.

(B) was made on the left side. A cross line (C) was made to pass through the appendix transversely. Another transverse line (E) passed through the lower poles of the kidneys, and still another line through the upper poles of the kidneys. The box was then filled with plaster, making a block 7 by 16 by 18 inches (Fig. 3). This was dried and then sawed along each line. As each section was cut, Trahar made an accurate tracing of the cavity, which is shown in the pictures in solid black. The plaster sections are here checked off in squares corresponding to one inch.

By these pictures (Figs. 4 and 5) it will be seen that with the subject standing erect, if a plumb line were dropped from the diaphragm so that it

passed through the abdominal cavity at the point where the appendix is attached to the posterior wall, much more than one half of the space on that side of the median line would be back of the plumb line, which we shall, for the convenience of study, call the perpendicular psoas line. If another plumb



FIG. 6A.—DIAGRAM SHOWING DIRECTION AND SHELF OF THE NORMAL ASCENDING COLON.

Arrows indicate direction of pressure produced by the weight of superimposed organs.

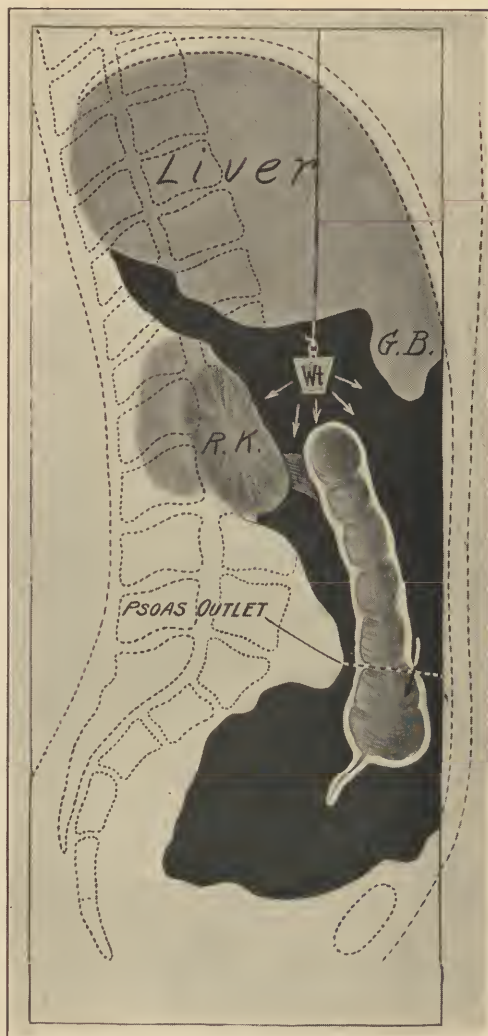


FIG. 6B.—DIAGRAM SHOWING PENDULOUS MOBILE CECUM SEEN WHERE ROTATION IS NOT COMPLETE.

This also shows its effect in displacing the right kidney, to which it is attached. Arrows indicate direction of pressure caused by the weight of superimposed organs.

line were dropped so as to pass along the front surface of the kidney, this line would be three inches back of the perpendicular psoas line and may be called the perpendicular kidney line. Another line one and one-half inches

further back would touch the back side of the kidney. The attachment of the hepatic and splenic flexures of the normal colon is external to the kidney and is even with its posterior surface. This attachment is four inches back of the perpendicular psoas line, and passes from the hepatic flexure forward to

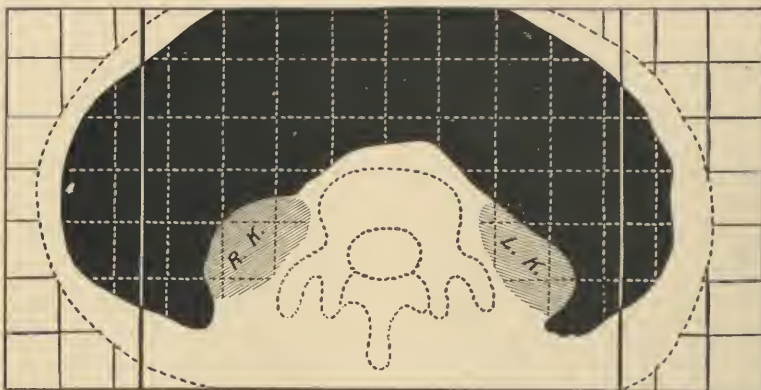


FIG. 7.—CROSS-SECTION OF THE ABDOMINAL CAVITY.
Area in square inches at the lower pole of the kidney.

the cecum or appendix at a fifty-one-degree angle (Figs. 6*A* and 10*A*). It will be noticed by observing these lines that fully two thirds of the right lobe of the liver is back of the perpendicular psoas line, so that the really heavy organs are found not to drag with a direct pull at all. In fact, the kidney

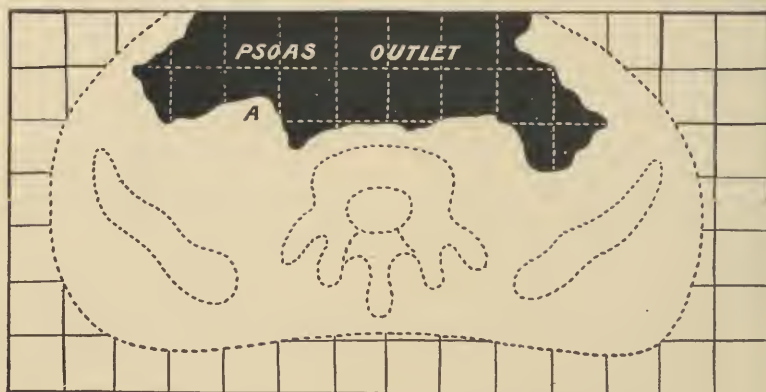


FIG. 8.—CROSS-SECTION OF THE ABDOMINAL CAVITY.

Area in square inches through the base of the appendix and the psoas muscles, the "Psoas Outlet."

rests on a four-inch shelf which is heavily padded with fat. It is held back by the normal retroperitoneal connective tissue plus the fused mesocolon, with its two layers of peritoneum, connective tissue, blood-vessels, etc. Therefore, in a normal individual, there is not the slightest tendency toward pro-lapse of the kidney. The ascending colon lies on a shelf and is held there by

fusion with the parietal peritoneum. It would not, therefore, even in the absence of intra-abdominal pressure, hang as a dead weight, as shown in Figs. 6B and 10B. On the left side, the splenic flexure is held at a higher level and further back than the right, or hepatic, flexure. These organs are held on this shelf to a certain extent by the strength of the abdominal wall in

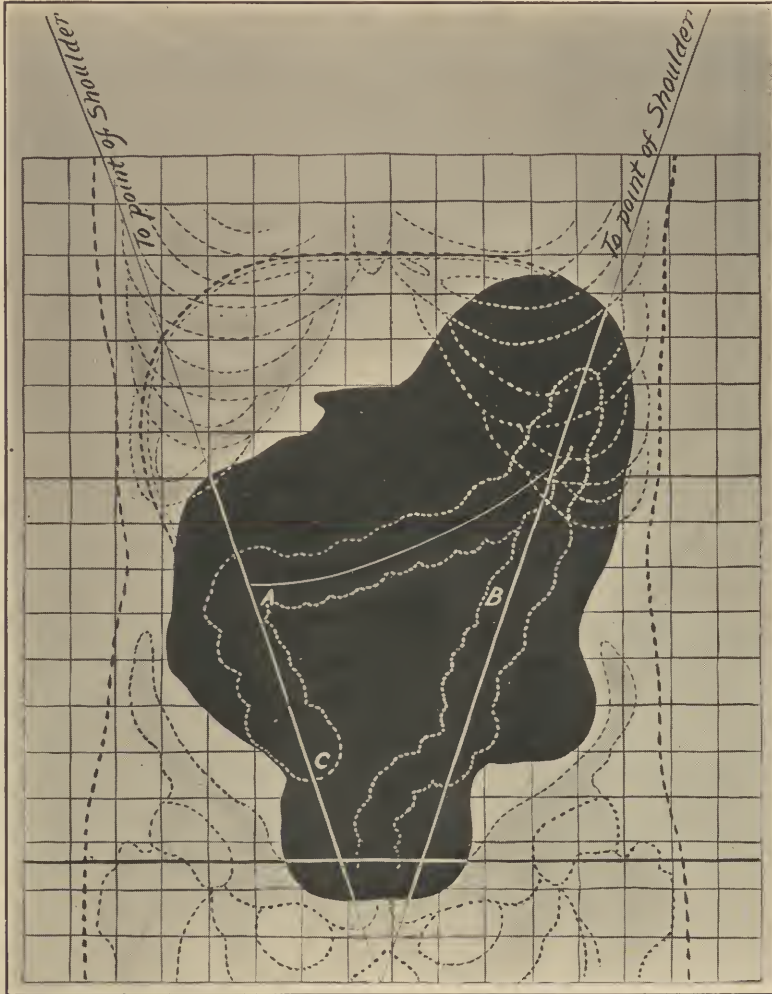


FIG. 9.—DIAGRAM SHOWING THE RELATIVE POSITION OF THE VARIOUS PARTS OF THE COLON TO THE MEDIAN LINE OF THE ABDOMEN.

This is represented on a horizontal plane. The white line A, B, C, indicates the line of section necessary to show the relation of the colon to the anterior and posterior abdominal walls on an anteroposterior plane as seen in Fig. 10 A.

front, much as if you had set a vessel on a shelf not quite wide enough to prevent it from falling off and had then nailed a strip in front of it. The weight held by the strip would correspond to the part played by the anterior abdominal wall in holding up the abdominal organs. The abdominal wall,

therefore, because of the shape of the abdominal cavity, becomes an element in holding the organs in position. In a normally well-developed man standing erect, a plumb line from the tip of the shoulder-blade should just about touch the buttocks. Opposite the lower lumbar vertebræ there should be a concavity in the back amounting to two or three inches. If an anteroposterior section is made through the flank of a normal man so as to strike the edge of the



FIG. 10A.—NORMAL RELATION OF THE VARIOUS PARTS OF THE COLON TO THE ANTERIOR AND POSTERIOR ABDOMINAL WALLS.

This is obtained by straightening the line A, B, C, in Fig. 9.

kidney, the base of the appendix, and the edge of the pelvis, the section of the abdominal cavity when looked at from the side is almost exactly the shape of a pear, the upper end corresponding to the large end of the pear, and the lower end, ceasing at the appendix, corresponding to the stem end of the pear. The pear, instead of standing erect on its small end, leans far back and rests on an inclined plane. It will be noted that the abdominal wall at the larger

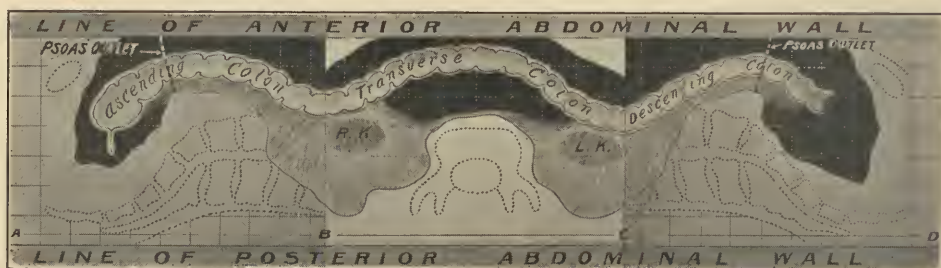


FIG. 10B.—RELATION OF THE VARIOUS PARTS OF THE COLON TO THE ANTERIOR AND POSTERIOR ABDOMINAL WALLS SEEN IN AN ANTEROPOSTERIOR PLANE IN A CASE OF GENERAL PTOSIS.

Note that the flexures are pulled out of the flanks and the kidneys are dragged out with them.

end near the diaphragm is very thin posteriorly, while the abdominal cavity is correspondingly large at this point, as indicated by a cross section at the lower pole of the kidney, which represents a cross section of the plaster cast. The area of this cross section covers 44 square inches (Fig. 7). At the base of the appendix the posterior abdominal wall is several inches thick. This thickness is produced by the curving forward of the spinal column at this point, and the crossing of the psoas muscles from their attachment to the vertebral column in the iliac fossa. This line we call the transverse psoas line. The

area of the cross section of the abdominal cavity at the front of the crossing of the psoas muscle, which we have called the "psoas outlet" of the abdomen (Fig. 8), is 14 square inches. In other words, the abdominal cavity is more than three times as large at the lower kidney line as it is at the transverse psoas or appendix line. The psoas muscles make a very abrupt shelf. On this padded shelf the kidney, ascending colon, and a large portion of the liver rest. On the left psoas shelf the descending colon, left kidney, spleen and stomach rest. It will thus be seen that nearly all the heavy organs are located so that they rest principally on these shelves. The main reservoir of the stomach, the cardiac end, rests back in the left flank. The middle pyloric portion of the stomach and the transverse colon are the two notable exceptions to this rule. These organs must depend entirely on the direct suspensory supports, and upon the intra-abdominal pressure. Hence, their great tendency to prolapse independently.

CHAPTER III

SUSPENSORY SUPPORTS OF THE ABDOMINAL CAVITY¹

It is often quite puzzling even to the doctor, unless a good deal of study is given, to understand fully the relation of the peritoneum to the various organs. I have used the following homely illustration:

A chamber or room is built and lined with cloth. The cloth is held to the walls, ceiling and floor by a network of elastic threads, the meshes of which are arranged in the form of diamonds or squares. In the ceiling of the chamber there are three openings through which three bodies are suspended with strings. Through the first opening a solid object, which we may designate as object No. 1, is suspended by a short string which barely allows it to go through the wall into the network. Through the second opening a solid body, which we may designate as object No. 2, is allowed to drop and push ahead of it a fold of the lining to such an extent that the lining and network of threads fall in behind it around the string. Through the third opening a hollow body, which we may designate as object No. 3, is dropped and is allowed to fall for a long distance, carrying the lining in front of it after which the lining and the mesh work of threads close in around the string. In the floor, there is a fourth opening through which a hollow body is pushed upwards. In front of it is pushed the lining. The lining and network fall in around the inserted hollow body.

Object No. 1 does not come in direct contact with the lining. It corresponds to the kidneys in relative position. In the instance of object No. 2, the cloth is glued to its surface and corresponds in its relative position to the covering of the liver. In the instance of object No. 3, which is a hollow body, the cloth has been glued to its surface and corresponds in relative position to the peritoneal covering of the gastro-intestinal tract. In object No. 4, which is a hollow body pushed up from the bottom, the lining membrane is glued to its surface part way and corresponds in relative position to the peritoneum covering the pelvic organs. The position of the string in case of the suspended bodies corresponds to the nerves, blood-vessels and lymphatics which are distributed to these various organs. The network of threads arranged in diamond meshes correspond in relative position to the connective tissue outside the peritoneum. If these meshes are filled with some soft padding like cotton, the spaces between the layers of the fold of cloth pushed inward by objects Nos. 2, 3 and 4 will become very much widened and at the same time shortened. The cloth-lining, instead of hang-

¹ *Surg., Gynec. and Obst.*, October, 1912, 365-429.

ing laxly down beside the wall, would stand out for some distance from the wall and would assume the appearance of a cushion. All the space occupied by this stuffing would diminish the clear capacity of the room inside the lining by just so much. This padding corresponds in relative position to the intra-abdominal fat.

In order to animate this illustration, let us state it in another way. The abdominal cavity is lined by peritoneum held to the wall by elastic connective tissue. Let us imagine that the germinal nuclei for development of the abdominal organs, including the kidneys, liver, gastro-intestinal tract and



FIG. 11 (LEFT).—DIAGRAMMATIC REPRESENTATION OF FAT CELLS.

These have been thrown into the shape of diamonds for the purpose of illustration. Diamond meshes filled with fat. Red lines indicate peritoneum.



FIG. 12 (RIGHT).—COLLAPSED DIAMOND AFTER ABSORPTION OF FAT.

This shows increase in length of mesenteries. White space shows increase of intra-abdominal space by absorption of fat. Red lines indicate peritoneum.

genital organs, have been placed at various locations within the abdominal cavity just outside the peritoneum and have begun to develop and increase in size. The kidney grows in size but does not grow inward. The liver grows extensively and pushes in front of it a fold of peritoneum which becomes an attached covering and helps to form Glisson's capsule. The gastro-intestinal tract grows and pushes a fold of peritoneum inwards for a long distance. The peritoneum grows firmly to the surface of the gastro-intestinal tube. The pelvic organs grow upwards and push the bottom of the peritoneal lining upwards. In the female, the peritoneum grows fast to the fundus

and surfaces of the uterus and falls in folds over the round ligaments. Connective tissue has been pulled inward along with the peritoneum to which it is attached. The meshes of this network have all been filled in with fat. All the space occupied by fat diminishes the net capacity of the abdominal cavity within the peritoneal sac by just so much (Figs. 11 and 12).

The sole suspensory support of the abdominal organs, aside from the problematical support afforded by blood-vessels and nerves, comes from the peritoneal layers of the mesenteries supplemented and supported by extraperitoneal connective tissue. The strength of these suspensory supports is increased by the filling and spreading out of the meshes with fat which doubtless acts in a mechanical way by holding the force at different angles corresponding to the direction of the fibers, producing much the same effect as the fabricated small pieces of steel arranged at different angles, hold together two stronger pieces of steel in the construction of one of the main supports of a bridge. Engineers have found that such an arrangement gives much greater strength in proportion to the amount of steel used.

By the above description, it will be seen that the abdominal organs are all extraperitoneal. This description corresponds to the arrangement of the mesenteries and peritoneum in the quadruped. As was shown in the second division of this chapter, the abdominal cavity is oblong. With the quadruped standing in a horizontal position, the organs are all suspended from just beneath the spinal column. This has been modified in the human being by the fusing together of certain peritoneal surfaces with the apparent purpose of fixing certain organs in preparation for assuming an erect position in which the oblong abdominal cavity stands on end.

Huntington's² book throws more light on the subject than any other publication which has come into my hands. In this book the author has taken up his study from the standpoint of comparative anatomy and embryology. In his introduction he says:

"In considering the anatomy of the human abdominal cavity and peritoneum in the following stages, the explanation of the adult conditions encountered is based upon the development of the parts, and the successive human embryonal stages are illustrated by the examination of the lower vertebrates, presenting permanent adult structural conditions, which appear as merely temporary embryonal stages in the development of the higher mammalian alimentary tract."

In studying the abdominal cavity from the standpoint of comparative anatomy, by this method we find that in man the liver has fused with the diaphragm, while in the quadruped it is in the same way, as other organs, suspended by a mesentery. In man the duodenum is firmly fixed to the right abdominal wall, while in the quadruped it is freely movable. In man the ascending and descending colon and the two flexures are normally fixed to the posterior abdominal wall without the intervention of mesentery, while

² *Anatomy of the Peritoneum and Abdomen*, Lea Brothers, Philadelphia, Pa.

in the quadruped the large intestine has a long mesentery, and is therefore freely movable. In man the great omentum grows down over the transverse colon and adheres to it. This does not occur in the quadruped. In man the omental bursa is usually obliterated by adhesion of its layers together. Obliteration does not take place in the quadruped. In man the pancreas has been rotated behind the peritoneum and fixed to the abdominal wall. In quadrupeds the pancreas lies between the layers of the mesentery. In

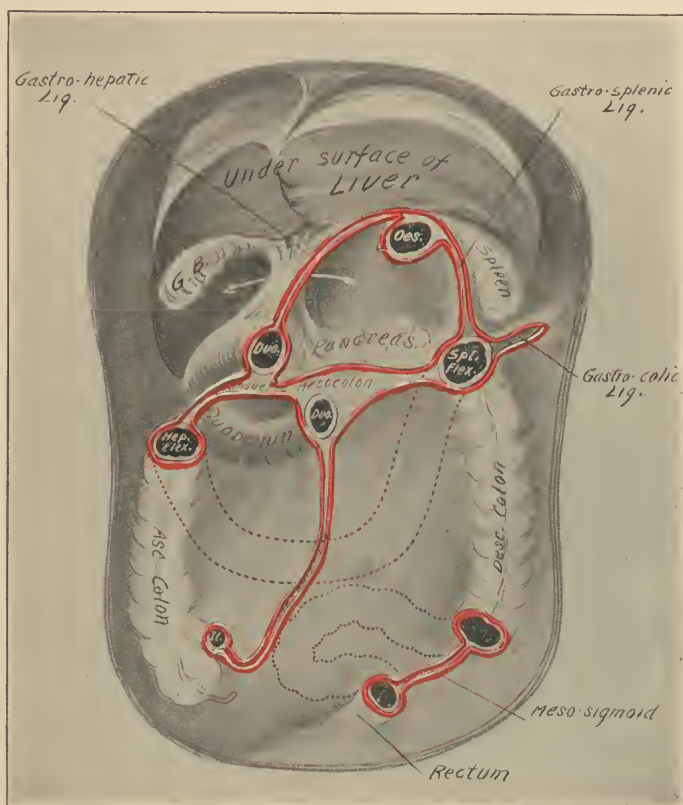


FIG. 13.—PORTIONS OF ALIMENTARY CANAL FIXED BY PRENATAL ADHESION OR FUSION.

Movable or pendulous portions of canal have been removed. Red lines represent cut peritoneal edges. Section of intestine made at junction of fixed and movable portions represent points where kinking may take place in certain cases of ptosis. Arrow passes through foramen of Winslow. Red lines indicate peritoneum.

the monkey, which is a quadruped with a tendency to stand erect, the pancreas becomes adherent and the duodenum is more firmly fixed than in the original quadruped (Fig. 13).

A question which confronts us is, Why these differences between the animals walking on four legs and those walking erect? I believe these prenatal fixations by adhesion or fusion in the erect animal are without doubt for the purpose of holding the organs in their places, thus to prevent them

from piling up in the bottom of the abdominal cavity by gravity when its long diameter is perpendicular.

In the lower forms of animal life, notably certain forms of fish, the alimentary canal is a simple straight tube. The capacity for variety of accomplishment and predomination of an animal is apparently dependent upon versatility of action which in turn calls for a variety of food. This necessitates a more complex alimentary canal in higher forms of animal life. In man the alimentary canal becomes a series of successive primitive canals, such as just referred to as existing in the lower forms of fish, arranged end to end, each performing an entirely different function and digesting a different kind of food. The mouth has an alkaline secretion and digests a certain small portion of the food. The bulk of the food is then passed on to the second section, the stomach, which has an intensely acid secretion and digests entirely different substances and breaks up other substances into a fine emulsion. This is passed into the third section, the duodenum, which receives pancreatic juice and other alkaline secretions and digests and further prepares the food just received from the stomach. The fourth section, the small intestine, absorbs most of the concentrated food products but passes a great part of the fluid bulk of the intestinal contents to the fifth part of the intestinal canal, the cecum. This is the great renovator and picks up certain valuable food products, including the water, which have passed through the small intestine without absorption, carefully separates them from nonnutritive, indigestible substances which are here destroyed or made inert by bacterial action and passes the waste on to the sixth part of the intestinal canal, the descending colon, sigmoid and rectum.

In the simpler forms of animal life all these functions are performed in the one straight tube. In other words, the primitive animal may be likened to the pioneer life when each family grew its own food and raiment and prepared it for use independent of coöperative action. The great advantage of coöperation in business and in professional life, made known to us in recent years, is but the carrying out of the scheme that nature has adopted in the human alimentary canal.

Between the lower fish, with its straight tube, and man, with his complex aggregation of digestive tubes, there is an infinite number of gradations, depending upon the kind of food consumed. Certain animals which are close companions of man, such as the dog and the hog, have adopted to a certain extent man's diet. This is particularly true of the hog, who is man's scavenger and therefore eats almost all the varieties of food that man eats. His alimentary canal is very similar to man's. The alimentary canal of a dog is quite similar. By having several tubes combined in one, its length is correspondingly increased and it becomes necessary for the intestines to curve and assume certain positions in conformity to the cavity in which they are held. This process of acquired conformity is often referred to as rotation. While the various parts of the alimentary tract of the quadruped rotate into, assume, and permanently occupy, a definite position in the abdominal cavity, they are by no means fixed in this position but hang from the

spinal column suspended by the dorsal mesogastrium. The position of the organs thus assumed in the dog is made permanent in man and fixed by a process of prenatal adhesion or fusion.

In Huntington's introduction he says:

"For the sake of clearness and brevity all discussion of the theories of peritoneal development has been designedly omitted. The assumption of peritoneal adhesion and consequent obliteration of serous areas offers many advantages in considering the adult human abdominal cavity, especially from the standpoint of comparative anatomy. The same has consequently been adopted without reference to divergent views and theories."



FIG. 14.—REPAIR FOLLOWING INTESTINAL UNION. (Modified from Barbat.)

Dotted lines indicate obliterated peritoneal areas which have fused as a result of being held together by sutures.

In the early fetal development of man, after the intestinal canal has become elongated and has adjusted itself, some of the primitive peritoneal surfaces coming in contact adhere to each other. The fibrous structures of peritoneum become intimately interlaced and actual fusion takes place such as takes place in the adult peritoneum when two peritoneal surfaces are held firmly together in an aseptic state (Figs. 14, 15, 16). What biological condition prevails in the development of the human fetus which causes these certain contiguous surfaces to fuse, while they do not fuse in the quadruped, apparently has not been satisfactorily explained.

In order to understand thoroughly these processes of rotation and fixation, it is necessary to review the embryo from the time of conception. As soon as the ovum has been fertilized by the spermatozoa, the cells begin to arrange



FIG. 15.—RESULT FOLLOWING SUTURING OF PIG'S OMENTUM TO ABDOMINAL WALL.
This shows perfect blending.

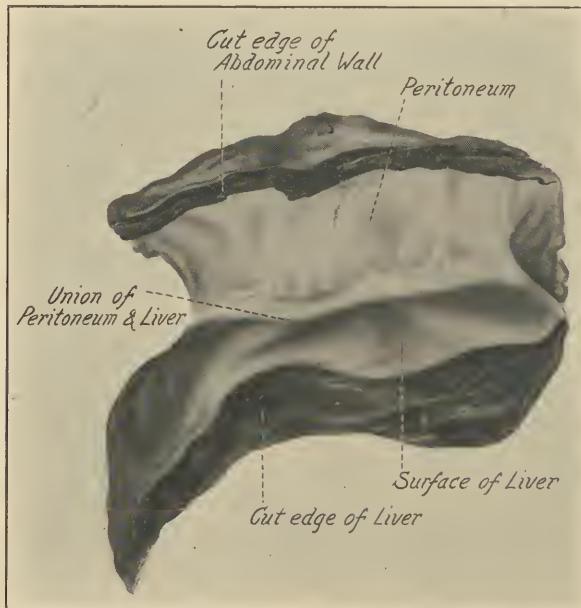


FIG. 16.—BLENDING OF PERITONEUM OF LIVER TO ABDOMINAL WALL.
Specimen removed from pig.

themselves in characteristic divisions which later are to play an important part in the formation of the various structures of the body.

The principal divisions are the ectoderm, from which the skin and spinal canal are formed; the entoderm, from which the lining of the alimentary canal is formed; and the mesoderm, from which bones, muscles, ligaments, etc., are formed. The entoderm, which at first has a direct connection with the yolk sac, very early fuses and the yolk sac disappears, leaving the straight intestinal tube seen in the early fetus and in lower animals. In the mesoderm, two lateral cavities form, which later become the serous cavities of the body. In the abdominal part of the fetus, the space on each side of the

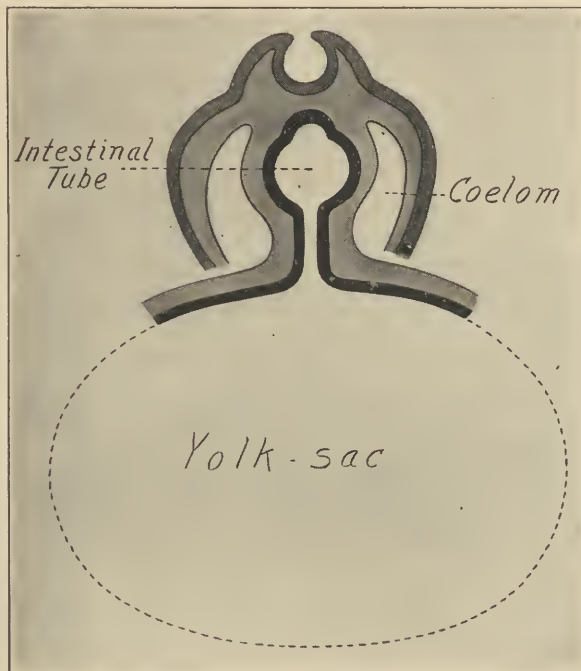


FIG. 17.—CURVES OF BLASTODERMIC LAYERS AND DIVISION OF MESODERM IN AMNIOTE EMBRYO. (Kollman.)

intestinal canal is known as the coelom. This is soon lined by a membrane which is later known as the peritoneum. These spaces extend from the back to the front of the body of the fetus. Between the two spaces lies the intestinal tube (Fig. 17). That part of the mesoderm between these two body cavities is gradually absorbed except such as is necessary to develop the muscular wall of the alimentary canal and the two lining membranes. Thus the intestinal canal lies between the two layers of the membranous partition which extends from the primitive spinal column to the primitive anterior wall of the fetus (Fig. 18). That part of the partition in front of the primitive alimentary tract is known as the ventral mesogastrium. That part of the partition lying back of the primitive alimentary tract is known as the

dorsal mesogastrium. Between the layers of the ventral mesogastrium, the liver with its ducts develops, while between the layers of the dorsal mesogastrium, the pancreas and spleen develop (Figs. 20 and 21). (A cross section in the line X-Y, Fig. 21, through the duodenum and the pancreas is represented in two stages in Figs. 19 and 22.) The liver in the fetus is a very large organ. It rapidly develops between the membranes of this partition and expands in all directions, thus taking up the slack of the ventral mesogastrium and thereby shortening it. The duodenum is drawn upwards and, as the alimentary canal develops, the stomach begins to grow backward between the layers of the dorsal mesogastrium and forms a curve (Fig. 21). At this stage of development it will be noted that the lesser curvature of

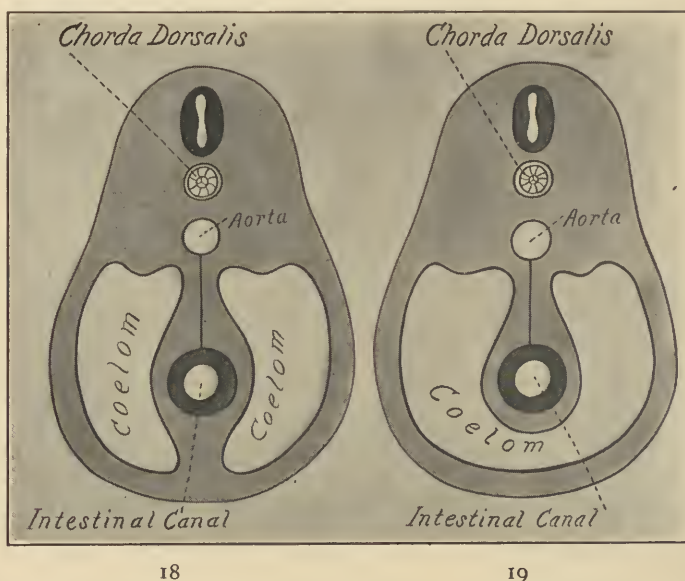


FIG. 18 (LEFT).—MESOGASTRIUM IN EARLY LIFE. (Huntington.)

FIG. 19 (RIGHT).—VERTEBRAE MESENTERY OR DORSAL MESOGASTRIUM BEFORE DEVELOPMENT OF THE PANCREAS. (Kollman.)

Illustrated by schematic diagram.

the stomach is directed toward the primitive abdominal wall while the greater curvature is directed toward the spine. As the stomach and intestine increase in length, their relations must of necessity be changed. The duodenum rotates to the right (Fig. 23) until it comes in contact with the parietal peritoneum on the right side where the contiguous surfaces fuse, as indicated in Fig. 24. This rotation of the duodenum to the right and to the back must necessarily twist that part of the ventral mesogastrium which extends from the liver to the stomach a half turn on itself. At the same time the stomach changes its relations. The dorsal mesogastrium elongates (Fig. 25) and this allows the stomach to change its position so that it rotates and slides toward the left side. That which was originally the left surface of the stomach now becomes the anterior surface and the greater

curvature which was directed toward the spinal column is now directed to the left and downward (Fig. 26). That portion of the anterior mesogastrium between the liver the stomach, instead of being parallel to the perpendicular axis of the liver, now becomes parallel to the transverse or horizontal axis of the liver and its name is changed to the gastrohepatic omentum or ligament. The large intestine, with its mesentery, which is a part of the dorsal mesogastrium, moves upward to the right and downward, stopping at the position indicated in Fig. 27, and settles back in contact with the posterior parietal peritoneum. The small intestine, which was

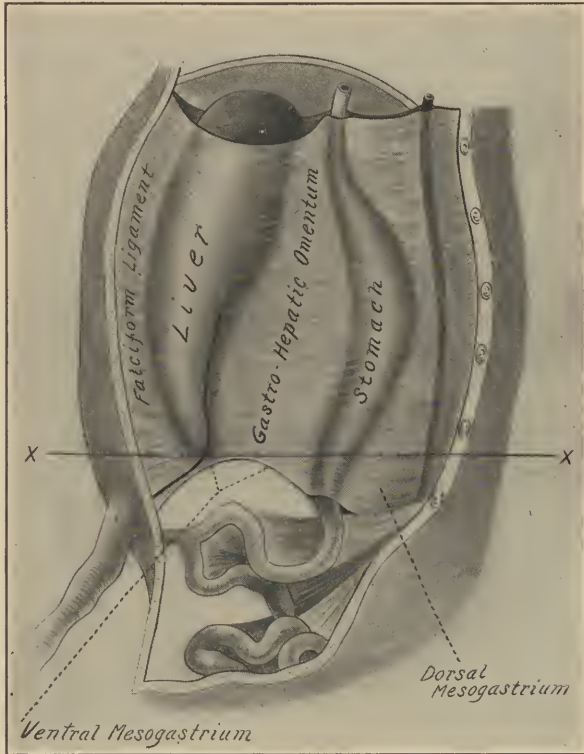


FIG. 20.—VENTRAL MESOGASTRIUM WITH DEVELOPING LIVER. (Modified from Huntington.)
Schematic profile view.

primarily on the right side of the body, now shifts to the left side. The peritoneum of the colon and its mesentery of the right side of the body and on the left side of the body comes in contact with the parietal peritoneum and the contiguous surfaces blend (Figs. 28 and 29). Thus that portion of the back of the abdominal cavity represented by the ascending and descending mesocolon is lined not only by the primitive parietal peritoneum seen in quadrupeds but by all the elements of the mesentery of the colon as well. The ascending and descending colon, along with the kidney, have during this process become partially retroperitoneal organs. A part of the transverse mesocolon fuses with the parietal peritoneum and with a portion of the

anterior surface of the duodenum (Figs. 30 and 31). Thus the duodenum has two fused layers of peritoneum behind it and two fused and one unfused layer in front of it at its lower portion. Fig. 32 shows the normal relations of the duodenum, kidneys, colon and mesentery with the small intestine removed. (The cross section at the line P-Q, Fig. 32, corresponds to Fig. 29.) The transverse mesocolon adheres only in part to the parietal peritoneum. The transverse colon is suspended by its mesentery from the fused areas (Fig. 31). It is therefore freely movable and pendulous.

While these processes of rotation and fixation are taking place, the great omentum, as seen in Figs. 27 and 33, is growing down over the colon where

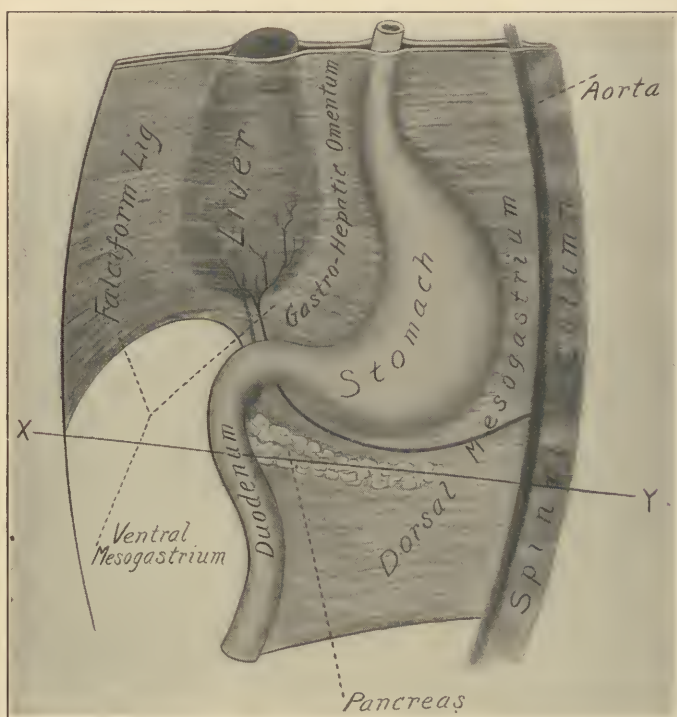


FIG. 21.—RELATION OF LIVER, STOMACH, AND PANCREAS TO THE MESOGASTRIUM JUST BEFORE ROTATION. (Modified from Huntington.)

its posterior peritoneal surface adheres to the peritoneum of the colon and mesocolon, and gives the colon two more fused layers of peritoneum for a support (Fig. 34). As a further support to the transverse colon, the omental bursa normally becomes obliterated by the adhesion of its contiguous peritoneal layers, as shown in Fig. 35, thus giving two more supporting peritoneal layers by the formation of the gastrocolic ligament. In the dog, cat and other quadrupeds, the kidneys lie behind the one layer of peritoneum, as shown in Fig. 36, and may be picked up and almost pulled out through an abdominal incision. This is made impossible in the human being by the additional support of the fused mesocolon with the parietal peritoneum.

FIG. 22.—FREE MESODUODENUM IN SAGITTAL PLANE.

This includes head of pancreas between right and left layers before rotation. Diagram corresponds to a section at the line X-Y in Fig. 21. Red lines indicate peritoneum.

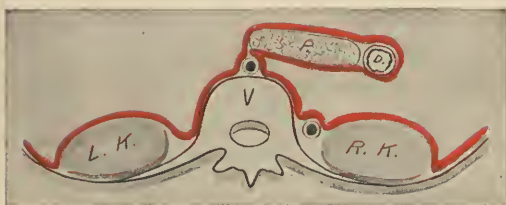
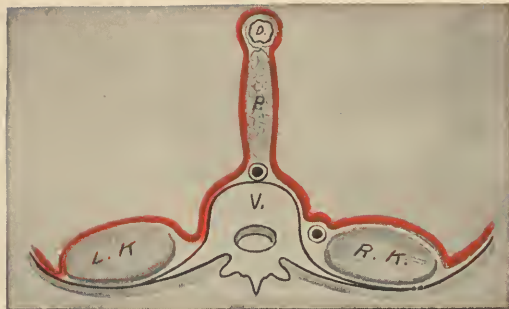


FIG. 23.—MESODUODENUM FOLDED TO THE RIGHT. (Redrawn from Huntington.)

Left leaf has become ventral; right dorsal, directed toward primitive prerenal parietal peritoneum. Red lines indicate peritoneum.

FIG. 24.—FIXATION OF HEAD OF PANCREAS AND DUODENUM UNDER COVER OF SECONDARY PARIETAL PERITONEUM. (Redrawn from Huntington.)

This is done by adhesion of opposed surfaces of mesoduodenum and primitive parietal peritoneum. Red lines indicate peritoneum, dotted red lines indicate obliterated peritoneal layers.

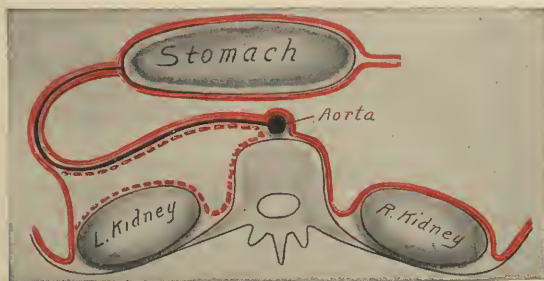


FIG. 25.—TRANSPOSITION OF STOMACH TO THE LEFT WITH BEGINNING ELONGATION OF DORSAL MESOGASTRIUM. (Redrawn from Huntington.)

This diagram corresponds to a cross-section of Fig. 26 at the line X-Y. Red lines indicate peritoneum, dotted red lines indicate obliterated peritoneal layers.

Huntington has drawn a diagram (Fig. 38) which shows the alimentary canal of the cat rotated into the position of the human alimentary canal. In case these organs were fused in the position shown, their relation would be represented in Fig. 39, which is not very different from the human, except that the liver is suspended by a mesentery in the cat, instead of being fused with the diaphragm as is seen in man.

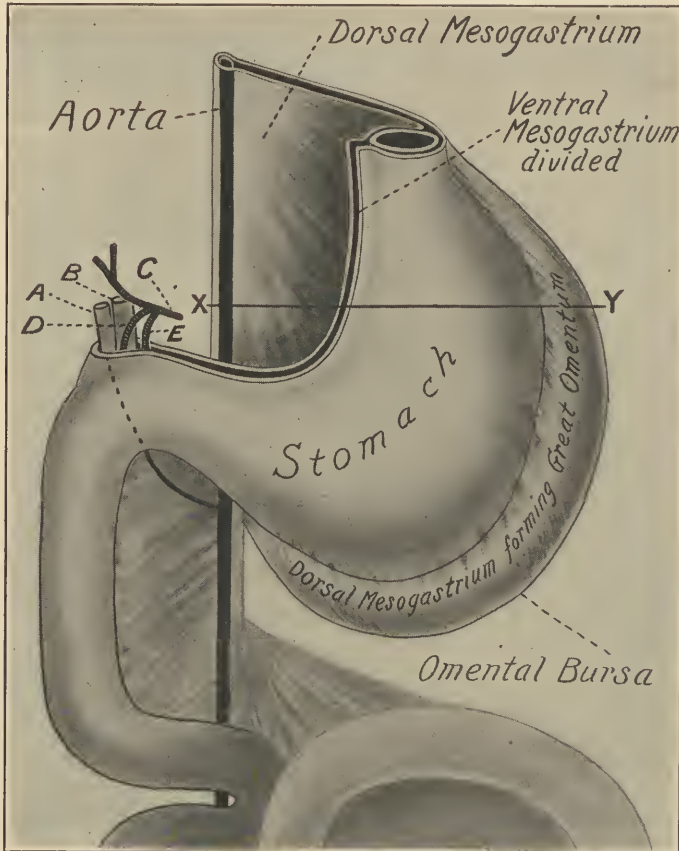


FIG. 26.—SCHEMATIC VENTRAL VIEW OF STOMACH, DUODENUM, AND DORSAL MESOGASTRIUM. (Modified from Huntington.)

Taken after rotation of stomach and extension of omental bursa caudad beyond greater curvature of stomach. The ventral mesogastrium is detached along the lesser curvature. *A*, location of hepatic duct. *B*, portal vein. *C*, hepatic artery. *D*, gastroduodenal artery. *E*, pyloric artery.

In summing up the peritoneal supports of the various organs anatomically, we find that in normal man the liver has actually fused with the diaphragm at its back side. The free margin is supported at its middle by the part of the primitive ventral mesogastrium which remains in the form of the falciform ligament. The pancreas is entirely retroperitoneal. The stomach is suspended from above by the esophagus and gastrophrenic ligament by which supports it is very firmly anchored. Its main body is located to the left of

the median line in an almost vertical position with its lower margin above the umbilicus, in a patient reclining; but just below the umbilicus in a patient standing, as indicated by X-ray pictures of normal stomachs. The body of the stomach is suspended from its lesser curvature by a double layer of rather frail peritoneum (the gastrohepatic omentum of ligament). After passing the median line the pyloric end of the stomach rises slightly until

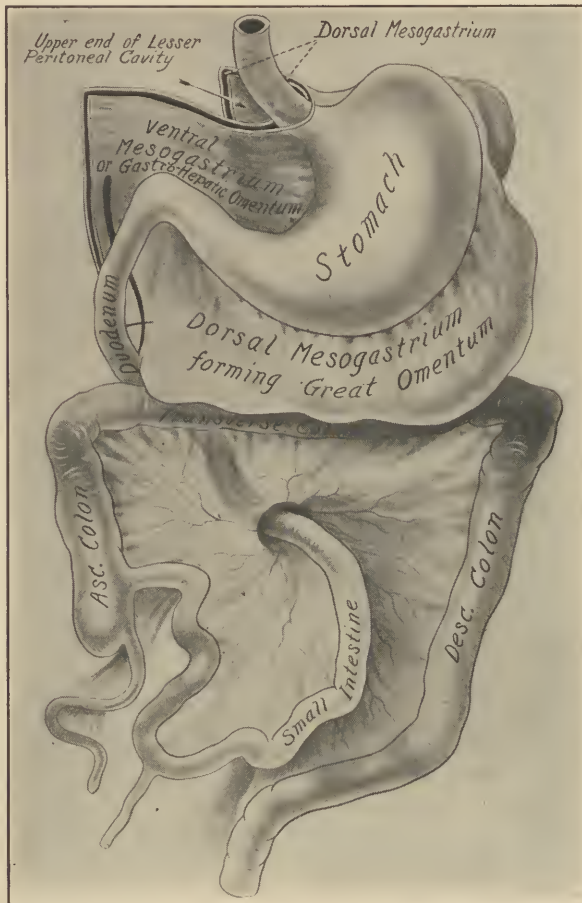
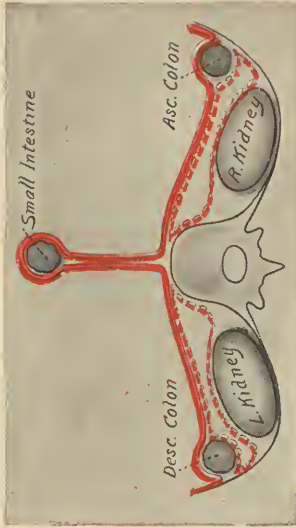


FIG. 27.—SEMIDIAGRAMMATIC REPRESENTATION OF PERITONEAL MEMBRANE IN HUMAN EMBRYO.
(Modified from Kollman.)

Rotation or transposition is taking place preparatory to fixation or peritoneal fusion.

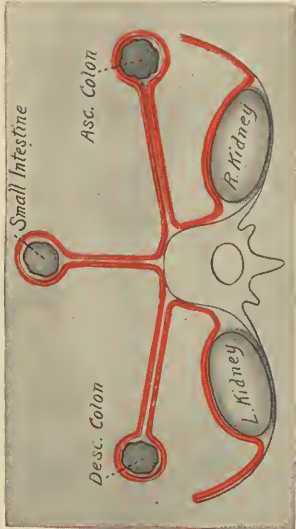
the junction of the first and second parts of the duodenum has been reached. Here is found what may be termed the folded edge of the primitive ventral mesogastrium. Between the layers of this folded edge are found (Fig. 26): first, the common bile duct, which is intimately connected with the liver by its many branches at one end and is firmly inserted into the second portion of the duodenum at the other; second, the portal vein, which is fixed to the stomach and duodenum by branches coming to it from this organ and is



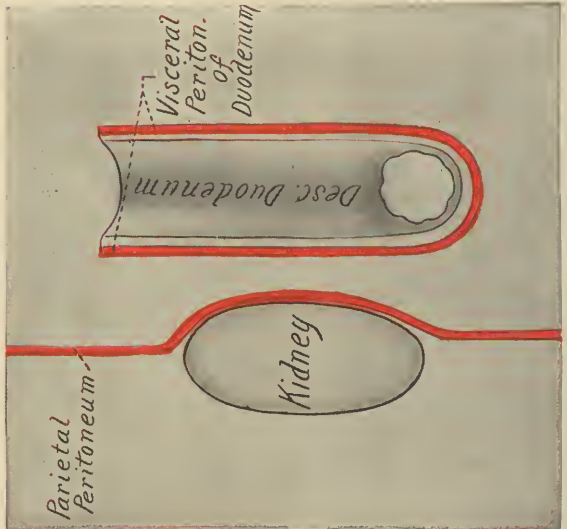
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FIG. 28.—PERITONEAL ARRANGEMENT BEFORE FIXATION. (Redrawn from Huntington.)

Scheme shown in transection of infracolic compartment of abdomen before fixation of ascending and descending colon. Red lines indicate peritoneum.

FIG. 29.—PERITONEAL ARRANGEMENT AFTER FIXATION. (Redrawn from Huntington.)

Scheme shown in transection of infracolic compartment of abdomen after fixation of ascending and descending colon. Red lines indicate peritoneum, dotted red lines indicate fused or obliterated peritoneal layers. Section corresponds to line P-Q in Fig. 32.

FIG. 30.—A SAGITTAL SECTION THROUGH THE RIGHT KIDNEY AND DESCENDING DUODENUM BEFORE ADHESION OF LATTER TO PARIETAL PERITONEUM.

Red lines indicate peritoneum.

FIG. 31.—ADHESION OF MESOCOLON TO DUODENUM AND PRIMITIVE PARIETAL PERITONEUM, RESULTING IN FORMATION OF ROOT OF TRANSVERSE MESOCOLON. (Redrawn from Huntington.)

Red lines indicate peritoneum, dotted red lines indicate obliterated peritoneal layers.

fixed at its upper end to the liver by penetrating it and distributing branches to all parts of this organ; third, the hepatic artery, which coming from the celiac axis distributes its branches to the entire body of the liver and is thereby firmly fastened at its upper end; fourth, the gastroduodenalis artery, a branch of the hepatic artery, divides itself into two branches, one penetrating and disseminating its minute branches to the duodenum and the other, the gastro-epiploica dextra, which by anastomosing with the gastro-epiploica sinistra sends branches to both surfaces of the greater curvature of the



FIG. 32.—RELATION OF DUODENUM AND KIDNEYS TO THE COLON AND MESOCOLON IN THE NORMAL INDIVIDUAL

stomach; fifth, the pyloric is given off from the hepatic artery and runs along the lesser curvature of the stomach where its branches penetrate both walls. All of these structures at the junction of the first and second portions of the duodenum are vital structures and are therefore permanent and constant and probably contribute to the establishment of the second permanently fixed point of the alimentary canal, the first point being the esophageal end of the stomach. The fixed supports, which include these structures, pass in front of the foramen of Winslow, through which the arrow passes in Fig. 13.

The duodenum, from this point to the ligament of Trietz, is chiefly a retro-peritoneal organ and is held back by prenatal fusion of its peritoneum with the primary parietal peritoneum and later by the fusion in front of it of a part of the transverse mesocolon, also by the crossing over it of the superior mesenteric vessels. Its last portion is fixed by the so-called ligament or muscle of Trietz. From the ligament of Trietz to a point near the ileocecal

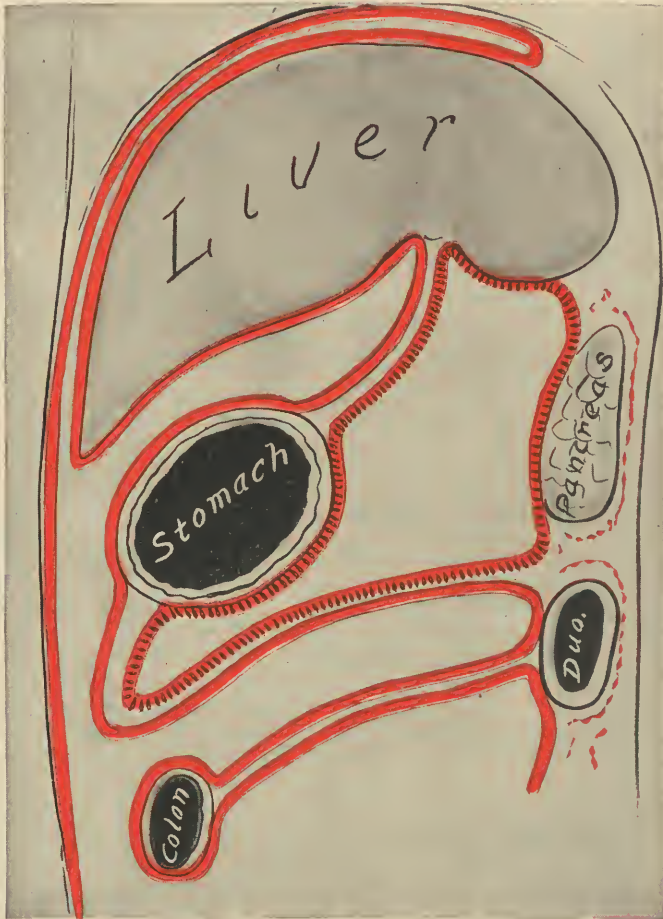


FIG. 33.—DIAGRAM OF THE FORMATION OF THE GREAT OMENTUM. (Redrawn from Sobotta).
Peritoneum is red and walls of the bursa omentalis are shaded. Dotted red lines indicate fused or obliterated peritoneal layers.

valve, the mesentery of the small intestine is long enough to allow considerable freedom of motion. Near the ileocecal valve it becomes decidedly shortened. The cecum and ascending colon, with its mesentery, is fused with the parietal peritoneum on the posterior wall and right side of the abdominal cavity. Its lower end comes to a point where the psoas magnus muscle crosses diagonally from the spine to the iliac fossa. Its peritoneum has fused with the right and lateral parietal peritoneum up to a point cover-

ing the lower third of the right kidney. According to Longyear, very strong fibers attach the upper end of the ascending colon to the kidney. From the hepatic flexure, the colon swings, somewhat sagging, across the abdomen to a higher point on the left lateral and posterior wall, where it is fixed by a very firm fusion (the costocolic ligament) and is supported by the gastrosplenic ligament. This is, therefore, a very firmly suspended point of the alimentary canal. The transverse colon is suspended by its mesentery and

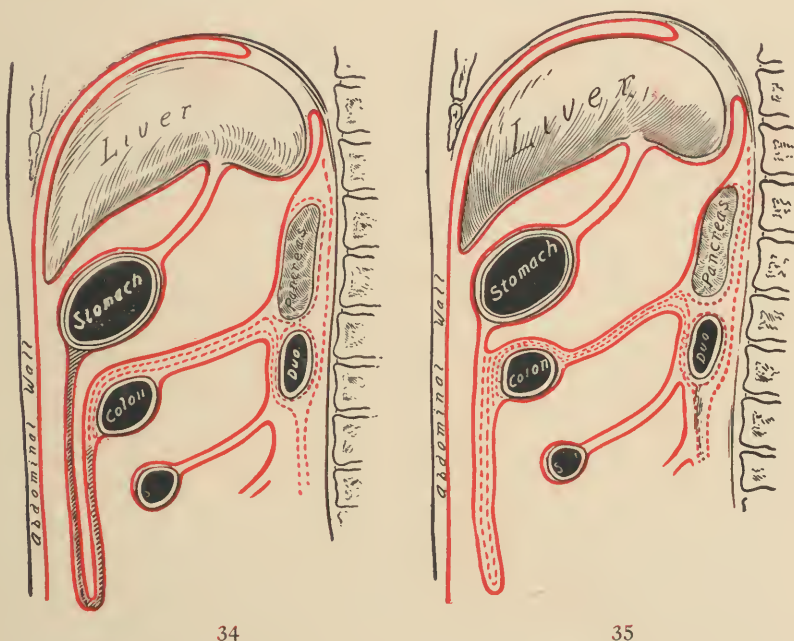


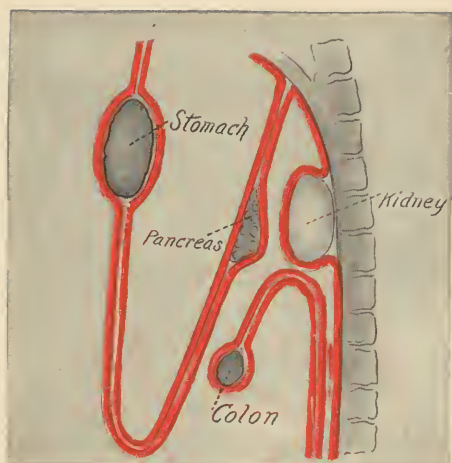
FIG. 34 (LEFT).—NORMAL ARRANGEMENT OF HUMAN PERITONEUM AND OMENTAL BURSA (INFANTILE STAGE).

Omental bursa not obliterated. Dotted red lines indicate fused or obliterated peritoneal layers. Red lines indicate peritoneum.

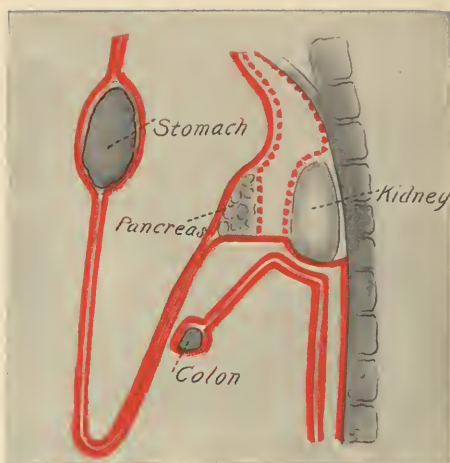
FIG. 35 (RIGHT).—NORMAL ARRANGEMENT OF ADULT HUMAN PERITONEUM.

This shows obliteration of omental bursa and formation of gastrocolic ligament. Dotted red lines indicate fused or obliterated peritoneal layers. Red lines indicate peritoneum.

by the gastrocolic omentum or ligament. The descending colon, beginning far back in the left flank, has fused with the lateral and posterior parietal peritoneum for from three to six inches, and thereby becomes a retroperitoneal organ and firmly fixed. The sigmoid flexure begins just above the crossing of the psoas muscle and has a long mesentery. After forming a fan-shaped loop twelve to eighteen inches long, it returns to the left iliac region and is again attached to the pelvic wall just below the psoas muscle.



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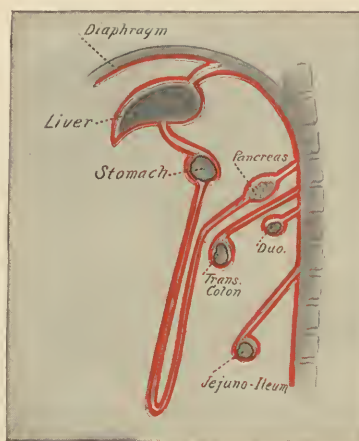
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FIG. 36.—SCHEMATIC SAGITTAL SECTION OF DORSAL MESOGASTRIUM AND OMENTAL BURSA IN MAN AND MONKEY. (Redrawn from Huntington.)

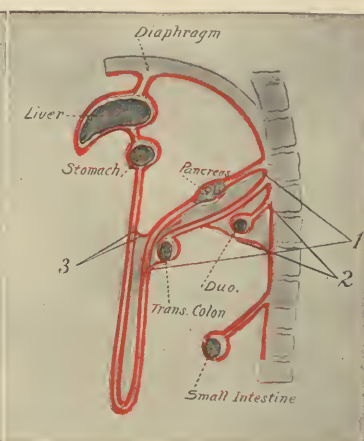
Taken before peritoneal fusion has taken place. Red lines indicate peritoneum.

FIG. 37.—AREA OF ADHESION BETWEEN THE DORSAL MESOGASTRIUM AND PRIMITIVE PARIETAL PERITONEUM IN MONKEY. (Redrawn from Huntington.)

Red lines indicate peritoneum.



38



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FIG. 38.—SCHEMATIC SAGITTAL SECTION OF ABDOMINAL VISCERA OF A CAT. (Redrawn from Huntington.)

Taken after the intestines have been rotated to correspond to the adult human position, to show lines of peritoneal reflexion before adhesion.

FIG. 39.—PERITONEAL ARRANGEMENT WHICH WOULD BE PRODUCED BY ROTATION AND FUSION OF THE VISCERA OF A CAT IN THE POSITION CORRESPONDING TO THE HUMAN.

(Redrawn from Huntington.)

CHAPTER IV

INTRA-ABDOMINAL AND INTRAVISCERAL PRESSURE ¹

In the foregoing chapter, speaking abstractly, we have been studying a chamber in which is suspended certain objects. We have learned that the walls of this chamber are partially flexible but nonelastic. The capacity of the chamber itself cannot be materially changed. In this chamber, we have suspended a number of objects, some solid, some hollow. These objects have been suspended in several ways: first, by cords, then by membranes, and finally by a meshwork of elastic cords or fibers. The meshwork is normally filled with a substance which, it is believed, aids in the support of the objects. All of these objects and their supports take up space and diminish the aggregate amount of space in the chamber by the amount of space thus occupied. Up to this time, we have presumed that the chamber is filled with normal atmospheric pressure. Therefore, the entire weight of the objects must be carried by the supports enumerated. We have failed, however, to take into consideration the very important fact that we are dealing with a closed chamber which, while not necessarily a vacuum, is air-tight and is therefore adapted to the development of various degrees of pressure.

I have made an interesting experiment as follows: An ordinary suction apparatus, connected with a water faucet by a rubber tube, which in turn is connected with an aspirating bottle by a T connection, tends to create a vacuum in the bottle, provided the distal end of the horizontal portion of the T is closed. If it is not closed, the air is drawn directly through the tube from the outside, and the air in the bottle remains in a state of equilibrium. If a very thin rubber bag is suspended in the bottle by a hollow tube passing through the cork and connecting the bag with the outside atmosphere, the air within the bag and within the bottle remains in a state of equilibrium so long as the distal end of the T connection remains open (Fig. 40 A). If this distal portion of the T connection is closed by forceps (Fig. 40 B), suction at once begins to reduce the pressure within the jar and thus tends to make a vacuum. Immediately the atmosphere rushes into the inclosed, suspended rubber bag and distends it in proportion to the degree of vacuum thus produced in the jar.

Thus, a law analogous to the law of osmosis can be formulated as follows: If a thin, elastic container with an outside connection for a source of supply of fluids or gases is inclosed within an inelastic container, there is a constant tendency to establish an equilibrium of pressure. For example,

¹ *Journ. Am. Med. Assoc.* (Butt. 11), September 19, 1917, 69:683.

if a portion of the contents consisting either of gas or of other substance is withdrawn from the outside inelastic container, the pressure on the outer surface of the elastic container is reduced, and a corresponding inflow of contents is brought into the elastic container from the outside for the purpose of establishing an equilibrium.

We do not know the amount of intra-abdominal pressure. It no doubt varies under different circumstances. We know by the law of specific gravity that, if a body heavier than water is suspended in the water, its weight is diminished in proportion to the weight of the water displaced. It may be stated that a similar law probably holds good within the abdomen, in that the portion of the weight of the organs, which is borne by their suspensory supports, is diminished in proportion to the amount of intra-

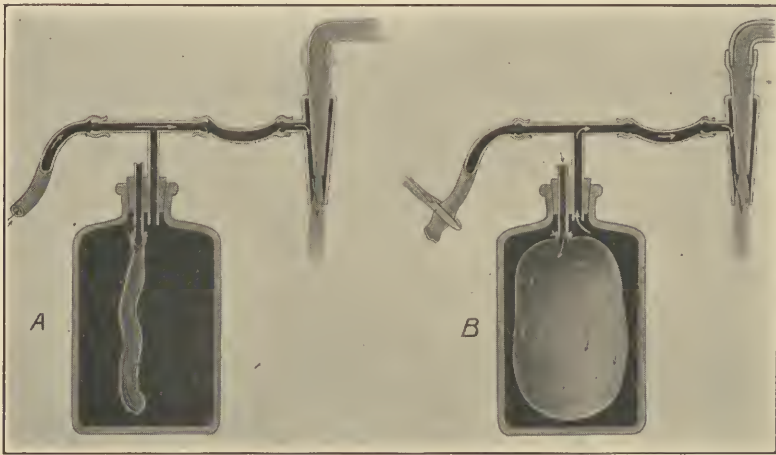


FIG. 40.—EXPERIMENT TO ILLUSTRATE THE RELATION OF INTRA-ABDOMINAL TO INTRAVISCERAL PRESSURE.

A, air in jar and in bag in state of equilibrium; suction not operative on contents of jar. *B*, pressure in jar being reduced by suction apparatus, showing inrush of air and distention of rubber bag in the effort to reestablish equilibrium.

abdominal pressure. As far as I know, the estimates which have been made are purely arbitrary. On one extreme, some believe that practically all the weight is maintained by intra-abdominal pressure while on the other extreme some believe that intra-abdominal pressure has no influence. Most conservative estimates based upon facts obtainable are that about one eighth of the weight of the abdominal organs and their contents is held up by the suspensory supports and seven eighths by intra-abdominal pressure. It is probable that most of this seven eighths of support attributed to intra-abdominal pressure is in reality borne by the psoas shelf and the intra-abdominal pressure made potent by the anterior abdominal wall. These organs are held on this shelf in much the same way as if one had set a vessel on a shelf not quite wide enough to prevent it from falling off and had then nailed a strip in front of it. The degree of intra-abdominal pressure depends on the

variable contents of the abdominal cavity. The variable contents are: (1) extraperitoneal and mesenteric fat; (2) the visceral contents. The visceral contents are liquids and gases and may be intermittently expelled at any time, thus acting as an immediate safety valve for the establishment of an equilibrium and a normal intra-abdominal pressure. The extraperitoneal and mesenteric fat is included within the inelastic abdominal wall, and lessens the abdominal cavity in exact proportion to the amount of fat thus included (Figs. 41 *a* and *b*).

The law that we have just stated as to interchange of forces between cavities has its counterpart in the relation of intra-abdominal and intra-visceral pressure.

Referring back to the law which we have stated and applying it to the abdomen, we may state that the abdominal wall is the outside, inelastic container, and the hollow viscera represent the inside, elastic container, with the outside source of supply through the mouth in the form of food. Within and partially filling the abdominal cavity is a variable quantity of fat. Intra-abdominal fat is apparently deposited under much lower pressure than are the cells of a tumor, pregnant uterus or ascitic fluid. The deposition of fat, therefore, within the abdominal cavity does not materially stretch the abdominal wall in a normal person. However, it is sufficient to increase the size of an already existing umbilical or postoperative ventral hernia.

If a large umbilical or postoperative ventral hernia exists for a long time in a fat patient, intra-abdominal fat is deposited in proportion to the extra-abdominal contents which have escaped from the abdominal cavity into the hernial sac, making it difficult, and at times impossible, to replace the hernial contents without removing some of the abdominal contents, such as the great omentum.

A patient who has been moderately fat (Fig. 42) for some reason loses flesh; the fat in the abdomen is correspondingly absorbed. The intra-abdominal pressure is lowered, and there is tendency to a gradual, atonic dilatation of the hollow viscera in establishing an equilibrium. Digestion is disturbed, bowel action becomes torpid, and all of the secretions are below par. The patient often develops into that low state of health ordinarily referred to as "asthenic," and, in extreme cases, has usually been referred to as "neurasthenic." If this poor state of health is permitted to go on for months or years, the abdominal muscles become weak and flabby and give way under the malnutrition and gas distention as well as the weight of the lowered organs, until finally the entire shape of the abdomen is changed (Fig. 43).

The late Weir Mitchell evolved a successful empiric way of treating these patients by rest, recumbency, forced feeding and massage. Being a neurologist, he attributed his success to "padding the nerves with fat."

Having briefly discussed the relation of intravisceral to intra-abdominal pressure, and having given a hint as to its bearing on clinical medicine, I shall next consider the relative pressure in the various parts of the intestinal canal, and its clinical importance. The word "jejunum" means empty. Very

little gas or fluid is found in it at one time. As the food passes down to the ileum, gas begins to form, and the intravisceral tension is greater. In the large intestine, a portion of the food and waste takes on bacterial digestion, producing a great deal of gas, and as a consequence the pressure within the large intestine is much greater than within the small intestine. So great is this liability to distention that nature has produced a valve, which has been done by a form of intussusception of the small bowel through a hole in the side of the large (Fig. 44A and B). This valve in a normal person is



FIG. 41A.—DIAGRAM ILLUSTRATING THE RÔLE OF FAT IN MAINTAINING THE TONICITY OF THE HOLLOW VISCERA.

A, normal amount of fat in fairly stout person (fat represented by white); stomach and intestine of normal thickness and size.

usually competent, so it is often found that the large intestine is greatly distended while the small intestine is relatively collapsed. A peristaltic wave traveling from the cecum toward the hepatic flexure creates diminished intravisceral pressure behind it. This diminished intravisceral pressure, following in the wake of the peristaltic wave, permits the ileum to empty a portion of its contents into the distended large intestine. When the wave has exhausted itself, the normal intra-intestinal pressure is again resumed and the valve again closed. The gradual obstruction of the large intestine in its

lower portion, by a growth of any kind, often produces such extreme intra-intestinal pressure as to reduce the normal intussusception of the small intestine into the large and thus to destroy the competence of the ileocecal valve (Fig. 44C and D). This I have demonstrated in doing Brown's ileostomy for obstruction in the sigmoid, for in those cases fluid which has been passed through the distal segment of the ileum into the large intestine

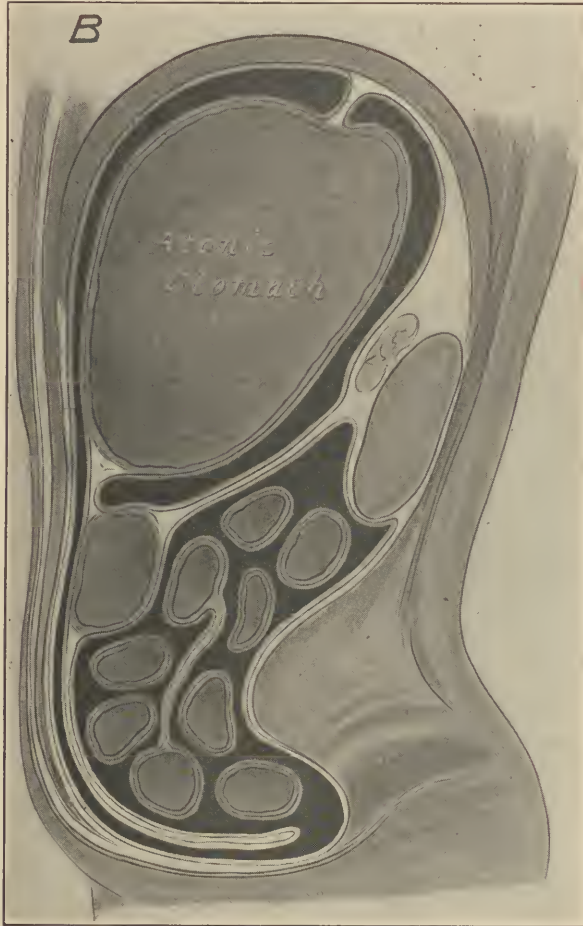


FIG. 41B.—PATIENT REDUCED IN HEALTH, FAT HAVING BEEN ABSORBED.

Abdominal cavity is enlarged, intra-abdominal pressure is reduced, and hollow viscera are distended and thinned in an effort to establish an equilibrium. Compare with 41A.

usually runs back, although the obstruction has been removed below, while, in ileostomy performed for ulcerative colitis, the colon may usually be flushed out through the distal segment of the ileum without a return from the colon through the ileocecal valve. Long-continued constipation, with large accumulations of gas in the cecum, is frequently followed by incompetence of the ileocecal valve (Fig. 44C and D). If this incompetence is

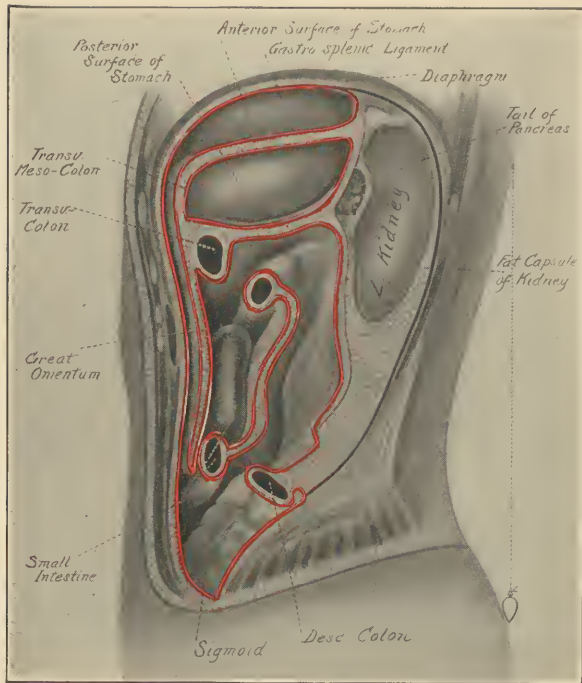
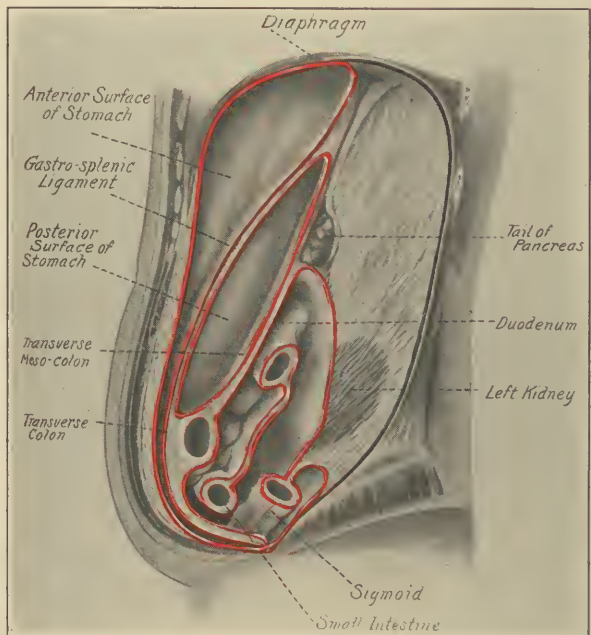


FIG. 42.—SAGITTAL SECTION THROUGH THE LEFT SIDE OF THE ABDOMINAL CAVITY. (Modified from Goldthwait.)

This shows the distribution of extraperitoneal and mesenteric fat in a normal individual. Lumbar curve normal, as shown by the plumb line.

FIG. 43.—SAGITTAL SECTION THROUGH THE LEFT SIDE OF THE ABDOMINAL CAVITY.

This shows absorption of extraperitoneal fat and the letting down of all abdominal organs, constituting a general ptosis. The belly is pendulous and the organs are found chiefly in front of the perpendicular psoas line. The plane of section, instead of being pear shape, as in Fig. 42, is oval. The lumbar curve is gone and the patient has assumed the "carrying position." Point of section same as Fig. 42.



complete and the regurgitation is extensive, it often has important clinical significance. J. H. Kellogg has devised an ingenious operation for reproducing the normal intussusception. I have seen a few cases in which the incompetence of the ileocecal valve produced such serious symptoms that I performed a modified Kellogg² operation for its relief, with functional satisfaction and complete mechanical restoration (Fig. 45A and B).

I have had occasion to operate on a considerable number of patients who had had short-circuiting operations performed by other surgeons who used

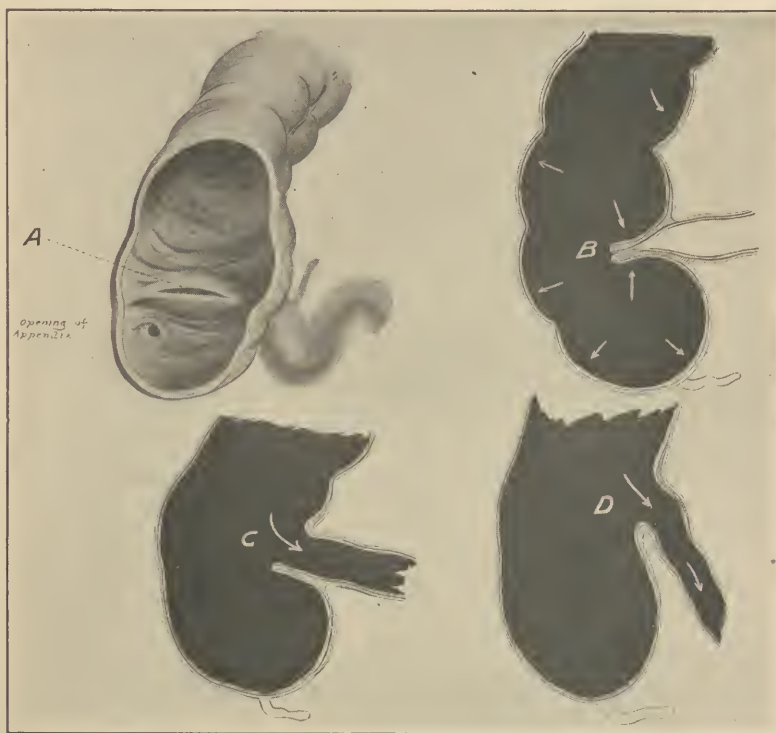


FIG. 44.—ANATOMICAL IMPORTANCE OF THE ILEOCECAL VALVE.

A, ileocecal slit and valve. (Gray's Anatomy.) B, diagram illustrating a competent ileocecal valve. (Elaborated from Gray's Anatomy.) C, partial incompetence of ileocecal valve. (Kellogg.) D, complete incompetence of ilcocecal valve. (Kellogg.)

Lane's method. In some cases, when performed by amateurs afraid to do the complete operation, a simple ileosigmoidostomy without severing the distal portion of the ileum had been performed. In all cases, whether or not the ileum was severed, it was very much dilated, showing that when the ileum is subjected to the greater pressure of the large intestine by an absence of an ileocecal valve, it becomes permanently dilated, no matter whether there are clinical symptoms or not. Figures 46A and 46B show this point in one of my own cases following ileosigmoidostomy. The colon in this case was later removed, at which time the ileum was found to be much distended

² *Surg., Gynec. and Obst.*, November, 1913, 17:658.

and thickened and it contained semisolid fecal matter for three or four feet above the point of anastomosis.

Next we may consider the relative degree of pressure in the hollow viscera themselves, and in the glands and ducts emptying into the viscera. In 1908-1909, while I was experimenting with methods for removal of the head of the pancreas in two stages, the first of which included the transplantation of the common bile duct to another portion of the duodenum, it

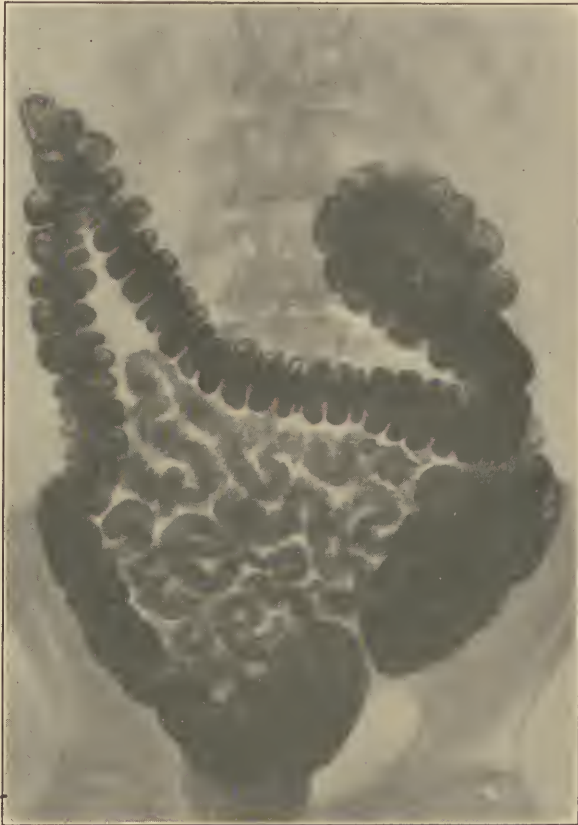


FIG. 45A.—ROENTGENOGRAM SHOWING CASE OF COMPLETELY INCOMPETENT ILEOCECAL VALVE.

This shows filling of entire small intestine with barium enema; clinical symptoms very marked.

was discovered that the duct which had been directly planted into the duodenum at the first operation was invariably found dilated at the time of the second operation (Fig. 47A and B). In one instance the duct was so large as the duodenum itself. The opening of the duct into the intestine was large, and all of the ducts well up into the liver were much dilated. This phenomenon, being observed in all cases, left but one rational conclusion to be drawn, namely, that the greater pressure within the intestine was too much when applied to the inside of the thin bile ducts. Investigation of the

duodenum and bile ducts of dogs showed that the normal duct, after passing through the muscular wall of the intestine, passed along immediately under the loose, movable mucous membrane for a distance of approximately half an inch before it entered the intestinal lumen. This was sufficient explanation of how the normal entrance of the bile duct prevented its dilatation by intra-intestinal pressure. The solution to the problem then was clear—the duct must be placed immediately under the loose, movable mucous



FIG. 45B.—COMPLETE RESTORATION OF THE VALVE.

Picture of same intestine shown in Fig. 45A, taken two months after operation, clinical symptoms entirely relieved. (Another picture taken one year after operation showed valve still competent. A picture taken two years after operation showed partial incompetence of valve with partial return of clinical symptoms.)

membrane for some distance before it is permitted to emerge into the lumen of the intestine, if the intra-intestinal pressure is to be brought to bear in closing the duct (Fig. 48). The technic of implanting the duct in this manner was quickly devised and tried on the living dog. Six ducts were implanted by this method, and not a single one of the ducts thus implanted showed material dilatation, in contrast with six implanted by the direct method, all of which were enormously dilated.

While this experiment with submucous implantation of the bile duct had been a complete success, so far as creating a perfect valve was concerned, there seemed to be some doubt as to whether the ureter, which entered the bladder in much the same way, could be implanted into the intestine with the same degree of success.

During the next year, after these experiments of the bile duct were undertaken, a series of experiments with the ureter were also performed



FIG. 46A.—ROENTGENOGRAM SHOWING DISTENDED ILEUM.

This commonly follows ileocolostomy. Ileum distended with gas and barium, immediately after one meal and twelve hours after another.

with perfect success, so that at the meeting at the St. Louis session of the American Medical Association, 1910, I was able to take five kidneys in which the ureter was implanted into the large intestines of dogs by the submucous method. In not a single instance had the kidney become diseased in any way. The valves formed by the submucous implantation were perfect (Figs. 49A and B and 50A and B). A large series of clinical cases by Dr. C. H. Mayo and a smaller one by Lower, Hunner, myself, and others, have procured clinical results just as good, so that the principle will apply

to the implantation of ducts at any point upon which it is depended to act for the proper control of intravisceral pressure.

In connection with this point, I may call attention to two other observations. First, every surgeon has noticed that the common bile duct becomes dilated sometimes to a large size after the gall-bladder has been removed or has been functionally destroyed by contraction down on gall-stones. In one instance of contracted gall-bladder, I found the common duct dilated to fully three fourths of an inch in diameter, which caused me to



FIG. 46B.—ROENTGENOGRAM SHOWING DISTENDED ILEUM.

This commonly follows ileocolostomy. Barium and gas in widely distended ileum twenty-four hours after picture shown in 46A.

open the bile duct looking for a duct stone, notwithstanding the fact that the patient had shown no jaundice or other evidence of common duct obstruction. Nothing was found in the duct, and the mouth was well open into the duodenum. Second, when a gall-bladder fistula is established with the surface, all observers have noticed that the bile flows more freely during the night or during intervals of digestion than during digestion. In other words, the bile flows into the gall-bladder during the intervals of digestion. The gall-bladder seems to serve as an elastic safety reservoir which takes off the

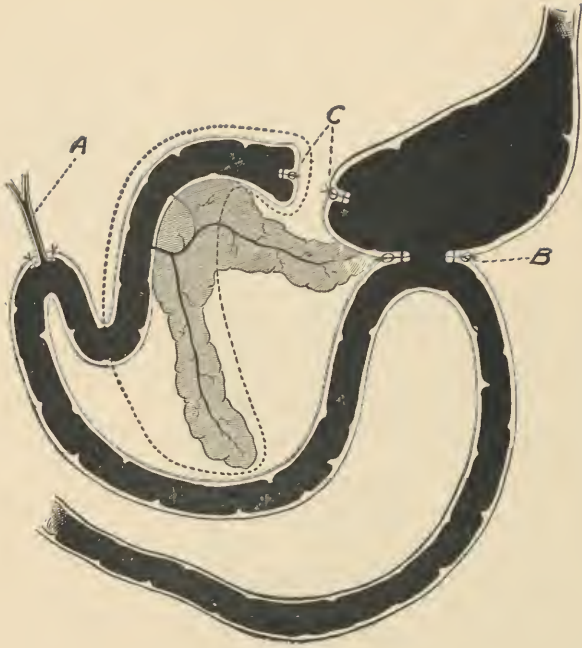


FIG. 47A.—COMMON BILE DUCT
IMPLANTED INTO DUODENUM.

This is done as a part of the first stage of operation, for removal of head of pancreas and duodenum, by direct implantation without valve protection.



FIG. 47B.—IMPLANTED COMMON
DUCT ENTERING THE DUODENUM.

This is shown taking place two weeks after implantation by the method shown in 47A. The duct has become widely distended and thickened during the intervening two weeks.

pressure from the bile duct at certain times of the day. It seems likely that this may be explained on the basis that, during active digestion, peristaltic waves are intermittently passing down the intestine. In the wake of these

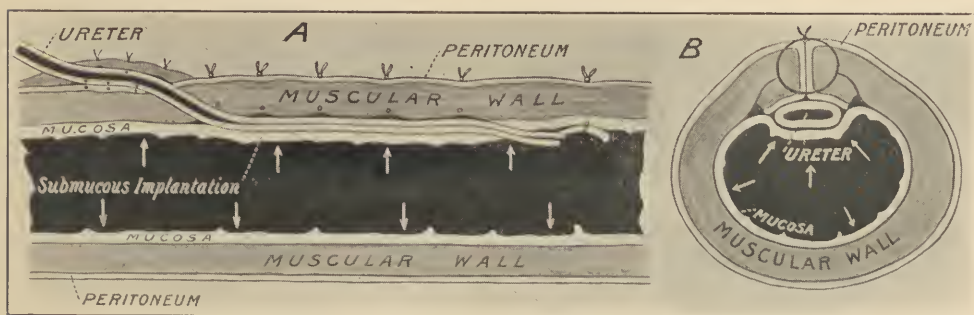


FIG. 48.—DIAGRAM SHOWING SUBMUCOUS IMPLANTATION OF A DUCT INTO THE INTESTINE.

A, longitudinal section; B, cross-section. Arrows show how the intra-intestinal pressure, acting on the movable mucous membrane, collapses and makes a valve.

waves there follows a diminution of the intra-intestinal pressure, which permits the temporary flow of bile from the duct. As soon as the wave has ceased, the normal intra-intestinal pressure is resumed and the valve is

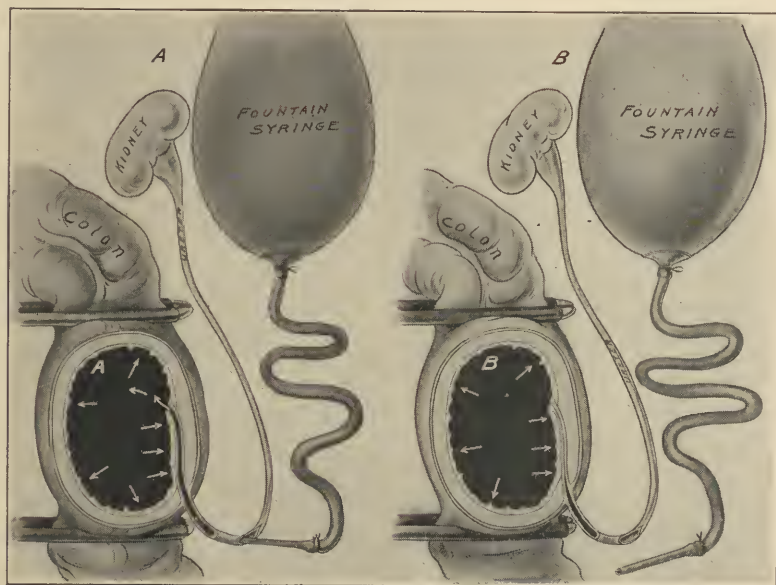


FIG. 49.—TESTING COMPETENCE OF THE VALVE IN A REMOVED SPECIMEN FOLLOWING SUBMUCOUS IMPLANTATION IN A DOG.

A, fluid run into the segment of intestine including the implantation area under pressure. B, outside pressure has been removed; intra-intestinal pressure closes valve completely.

closed. During long intervals of digestion, and particularly during the night, the peristaltic waves are few. The intra-intestinal pressure is more nearly constant, and the bile is forced out into the gall-bladder, or out through a

gall-bladder fistula as the case may be (Fig. 51A and B). H. Kehr found that if he fed his patients frequently during the night the flow ceased as in the daytime. If the gall-bladder has been removed or destroyed, an equilib-



FIG. 50A.—NORMAL VALVE IN A DOG'S BLADDER FOR COMPARISON WITH FIG. 50B.

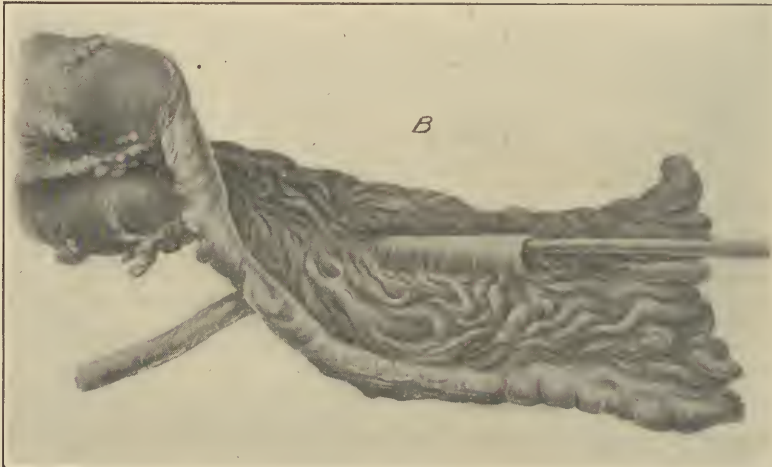


FIG. 50B.—POSTOPERATIVE VALVE FOLLOWING SUBMUCOUS IMPLANTATION OF A URETER IN A DOG'S LARGE INTESTINE.

Picture taken 167 days after implantation. This represents the same specimen shown in Figs. 49A and 49B, in which the valve acted perfectly without leakage.

rium of pressure in the gall-ducts and intestines is established in the long intervals between peristaltic contractions, with the result that the full degree of intra-intestinal pressure exerted on the bile ducts during the intervals of digestion produced permanent dilatation of the duct (Figs. 52A and B). To

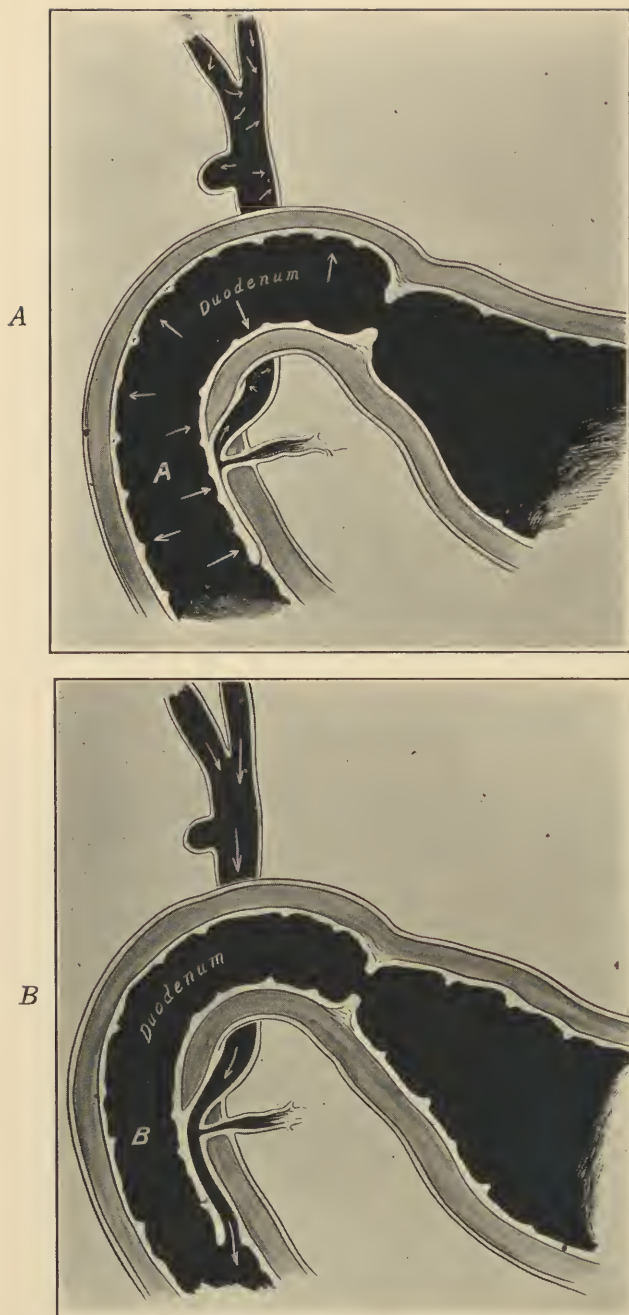


FIG. 51A.—DIAGRAM SHOWING INFLUENCE OF PERISTALTIC WAVES ON THE GALL-BLADDER.

Arrows in the gall-duct and gall-bladder indicate direction of bile during intervals of peristaltic waves. Arrows in duodenum show how intra-intestinal pressure closes the valve during intervals of peristaltic waves.



FIG. 51B.—THE FLOW OF BILE FROM THE GALL-BLADDER AND DUCT FOLLOWING IN THE WAKE OF A PERISTALTIC WAVE.



FIGS. 52A, 52B.—DIAGRAM ILLUSTRATING A THEORY AS TO THE PROBABLE CAUSE OF DILATATION OF THE COMMON DUCT FOLLOWING REMOVAL OR DESTRUCTION OF THE GALL-BLADDER.

A, during intervals of digestion (as at night) the valve is closed by intra-intestinal pressure, thereby producing an equal pressure in the ducts, causing them to dilate. *B*, during digestion, local intra-intestinal pressure is intermittently released in the wake of peristaltic waves, permitting the emptying of the dilated bile ducts, just as the normal duct and gall-bladder are emptied.

control this feature after cholecystectomy Terry feeds his patients frequently throughout the twenty-four hours. Careful application of the principles set forth and illustrated in this chapter, to the study of the atonic, dilated conditions of the gastro-intestinal tract accompanying the lowered intra-abdominal pressure of emaciated ptotic individuals, adequately explains the dilatation of the ducts and the stagnation of secretions known to take place in these patients and probably explains in a large degree the asthenic, toxic state so frequently manifested in such cases.

CHAPTER V

COMPARATIVE ANATOMY AND PHYSIOLOGY OF THE GASTRO- INTESTINAL TRACT

The discovery of the principles of asepsis and anesthesia have made possible, in the hands of a competent surgeon, such wonderful and revolutionary achievements that the surgeon seems likely to be maddened with success. A competent surgeon can remove any organ in the abdominal cavity, with the possible exception of the liver and the pancreas, and he can remove even a part of these organs, and the patient will recover. A few years ago a surgeon's success was measured by the fact that his patients did not die as a result of operation. Some still use this standard, but the time has arrived when our patients demand more. They demand now that we shall make them well and comfortable. In other words, our surgery has been purely anatomical in the past. We have now entered upon the physiological era of surgery. The noted anatomist and physiologist, Keith, of England, after studying the work of Lane, Metchnikoff and Barclay Smith, all of whom consider the large intestine as an unnecessary cesspool, the products of whose stagnation poison the entire body, says that if these statements are well founded, medical men are face to face with a condition which threatens the health and survival of modern civilized races. In an article published in the *British Journal of Surgery*, April, 1915, Keith has the following to say:

"I have not any doubt that in years to come Sir W. Arbuthnot Lane will be recognized as one of the great pioneers in intestinal surgery. He was the first to perceive that disease of the great intestine was very common, and the real cause of untold illnesses. He had the courage to act on the belief that no colon was better than a diseased colon. But in so far as he regards the normal and healthy colon as a mere sewage system, I totally disagree with him. We must remember that its mucous membrane is a purely glandular structure of unknown—at least of uncertain—function. If we bring the glandular tissue together to form a solid mass, we have a gland considerably larger than the pancreas. All its cells are active. If we roll up its musculature, we have a mass of contractile tissue, furnished with an elaborate and complex neuromuscular system, big enough to form a muscle as large as the biceps of a blacksmith's arm. That is not quite the composition we expect in a merely mechanical, effluent sewage system. The fact that health can be maintained after complete removal of the colon does not prove that it is either a useless or a vestigial structure; it is simply another

example of the well-known law that nature has endowed the animal body with a potentiality far beyond the demands of a routine life. We seldom use our lungs beyond one third or one half of their full functional capacity. We can excise the spleen and many other organs and parts of the body; but that does not prove that organs or parts so excised are useless; merely that the systems of the body have a wonderful adaptability and power of acting as partial or complete substitutes for each other. I particularly wish to insist on the unknown utility of the large bowel, because if we consign it to the list of useless or injurious organs, then we cease to regard it as an object which urgently requires research and investigation. The moment we relegate it to the position of a sewage pipe or a vestigial organ, we have really excommunicated it from the minds of the young and hopeful scientists of the coming generation.

"There is no doubt that in all cases of intestinal stasis there is a disorder of the neuromuscular mechanism of the great bowel, but we cannot explain that disorder in the present state of our knowledge."

In another article published in the *British Medical Journal*, December 7, 1912, Keith insists that before assigning so large a part of man's digestive tract to the list of the useless structures, it would be well to inquire regarding the various members of the animal kingdom. Instead of practicing excision in the effort to adapt our digestive tract to our present dietary, Keith suggests that we may discover a diet which will be suited to our present digestive tract, and in order to do so, we must know something of the normal processes of the digestion of vertebrates in general.

I am sure that Keith is correct and that the key to our present situation is to be found in a more thorough study of comparative anatomy and physiology. The large intestine, and particularly the cecum of an animal, almost tells the form of diet that is required. For instance, in herbivora, we find the large intestine long in proportion to the small intestine, while in carnivora it is short. The omnivora, which includes man and the hog, have a medium intestine. In man and hog the small intestine is about four times as long as the large. In the horse, rabbit and deer it is only about twice as long as the large intestine, while in birds of prey like eagles and hawks the small intestine is about seventy times as long as the large.

The cecum is a very important part of the intestinal canal. We may profitably study two large lizards. The Gila monster found in the Central American countries feeds almost exclusively on birds' eggs, a very easily digested food. His intestine does not change its size, and the only demarcation between the large and small intestine is a single valve or muscle by which food may be retarded (Fig. 53). The Iguana Tuberculata is another tropical lizard, somewhat larger but very much the same kind of animal, having entirely different diet. The Iguana has a small stomach and short small intestine and a tremendously large and complicated cecum (Fig. 54). Its diet is entirely vegetable and it is said that the cecum always contains undigested vegetable matter. In Fig. 55 it will be seen that the food in the

first place may be held in the small intestine by the small opening into the cecum until it is well mixed with the digestive juices. It then passes into one chamber and from this to another and another and another, being held in each one for some time in order that digestion already begun may be finished and additional preparation by bacterial digestion may take place in the cecum. The Agouti, a herbivorous animal resembling a raccoon, has a tremendously large cecum (Fig. 56). Considering birds, it is found that



FIG. 53.—JUNCTION OF LARGE AND SMALL INTESTINE OF THE GILA-MONSTER, SHOWING THE VALVE SEPARATING THEM. (Redrawn from HUNTINGTON.)

the hawk and the eagle have practically no cecum (Fig. 57). Their diet is chiefly meat with very little indigestible matter. On the other hand, the ostrich has a large intestine about twice as long as its small intestine and two large and long ceca (Fig. 58). The ostrich eats nuts with hulls and other forms of very indigestible substances and takes care of them. The hog, being an omnivorous animal, has a small intestine more nearly like that of the human than any other domestic animal; but the large intestine is arranged in loops like a radiator. The present-day refined and high-

bred hog has an intestine about 140 per cent longer than his ancestor, the wild hog. Whether this is due to the fact that high breeding has incidentally by selection picked the hog with the longest intestine, and, therefore, the most perfect digestion, or whether his change of diet from nuts, worms and concentrated foods to the largely vegetable diet has caused an increase in his intestinal canal, is hard to say. His diet now is chiefly vegetable and he thrives on alfalfa, clover, etc. The large intestine in the present-day hog is quite necessary as shown by experiments.

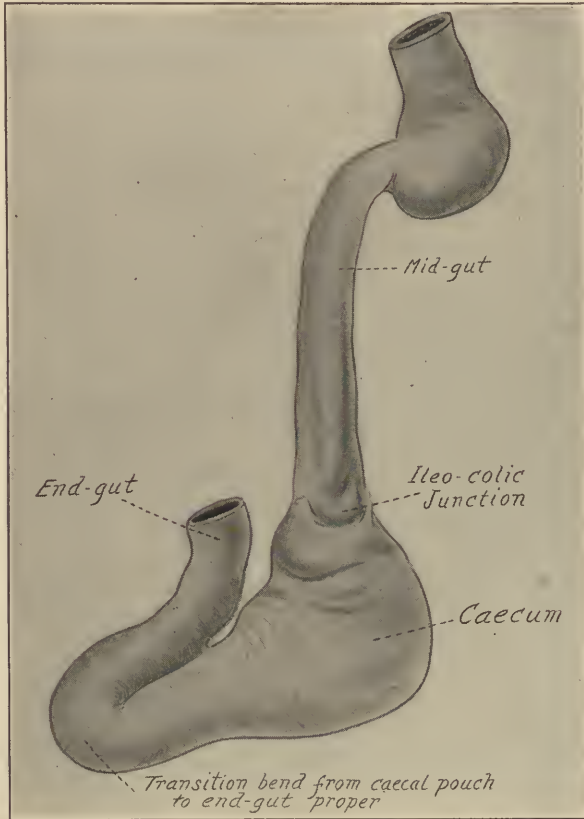


FIG. 54.—GASTRO-INTESTINAL TRACT OF IGUANA TUBERCULATA. (Redrawn from Huntington.)
Note the long stomach, short mid-gut and large caecum.

Alglave,¹ in 1907, made a series of experiments on dogs and hogs as well as on herbivora. He found that an ileosigmoidostomy without exclusion did not materially affect the dog whose diet has gradually been changed by association and evolution from strictly carnivorous to that of his friend and companion, man. Ileosigmoidostomy with unilateral exclusion affected the dog's nutrition, but did not prove fatal, while he found that the pigs, whose diet and intestines have been changed by evolution largely to that of herbivorous, on which ileosigmoidostomy with unilateral exclusion had been

¹ *Rev. de Gynéc. et de Chir. abd.*, 1907, 11:51.

performed, died within five or six months. Pigs on which ileosigmoidostomy without exclusion was performed were very materially retarded in growth and

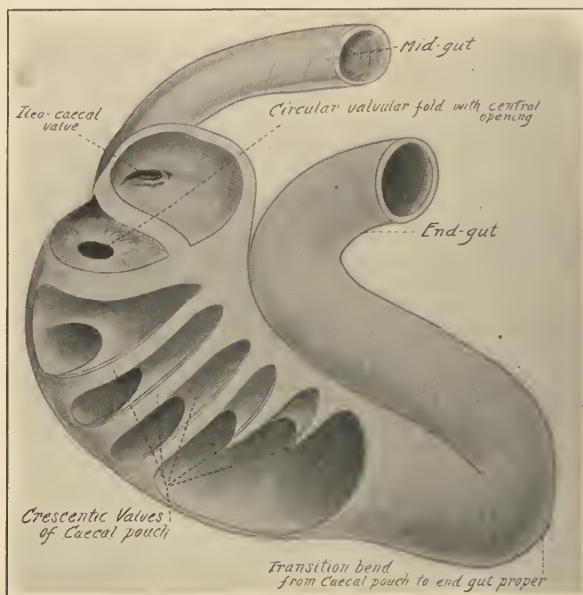


FIG. 55.—SECTIONAL VIEW OF THE CECUM OF IGUANA TUBERCULATA. (Redrawn from Huntington.)

development, but did not die. The younger the pig when operated on, the more the health was retarded, as shown by the study of three pigs of the

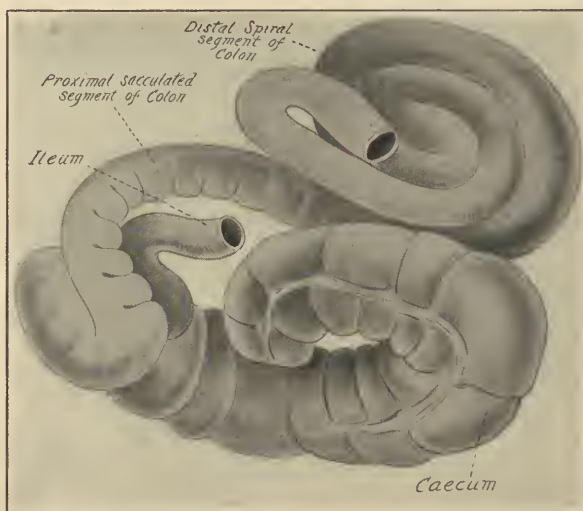


FIG. 56.—ILEOCOLIC JUNCTION, CECUM AND COLON OF AGOUTI. (Redrawn from Huntington.)

same litter fed with the same food. On one, ileosigmoidostomy without exclusion was done at two months old. On another the operation was done

at three months old, and on still another no operation was performed. The first pig at a year old weighed thirty-four pounds, the second pig at the same age weighed seventy-nine pounds, and the third, upon which no operation had been done, weighed two hundred pounds. It was found that exclusively herbivorous animals all died as the result of the simple short-circuiting operation without exclusion, while strictly carnivorous animals do well without the large intestine.

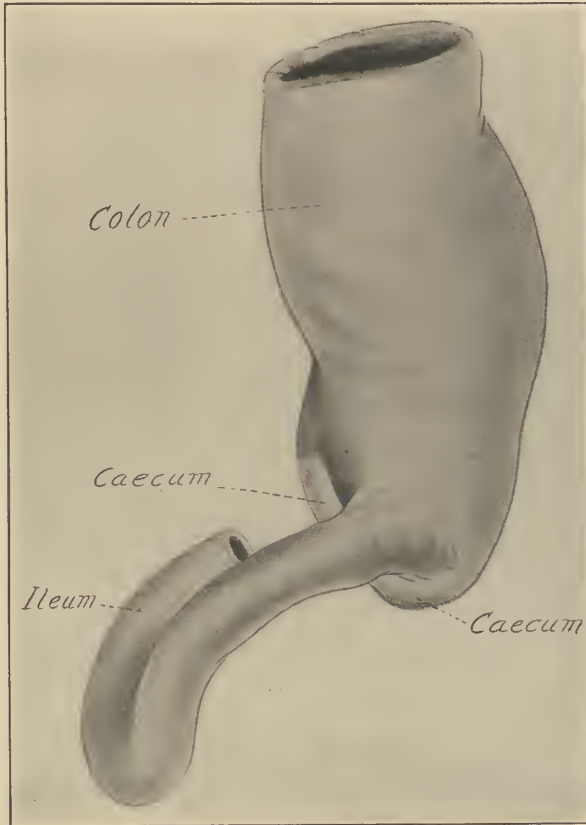


FIG. 57.—THE ILEOCOLIC JUNCTION AND CECA OF BLACK HAWK. (Redrawn from Huntington.)

In 1913, I had the opportunity to study the clinical work of the late Dr. John Young Brown of St. Louis, who had advocated ileostomy for a number of years, excluding the entire large bowel in certain cases. He showed me one case on which he had done a permanent ileostomy for mechanical reasons nine years before, and gave me the privilege of questioning the patient. She was a hard-working woman and yet appeared to be in perfect health. I asked her what happened when she took vegetable in quantities. She said that it produced no disturbance, except that the vegetables passed through undigested to a certain extent, and sometimes produced diarrhea. Dr. Brown also called my attention to the fact that there was

practically no odor to the escaping contents which were caught in a contrivance bandaged to her side. The patient confirmed this by stating that the odor of her fistula was never noticed by members of her family. Dr. Brown informed me that this was the rule in such cases. I have had a considerable number of patients on whom the Brown operation has been done by me for disease of the colon, all of whom have markedly gained in weight and strength, and so far as we can tell are in good health with the entire large intestine completely out of commission many months after the operation. So it is clear that man can do without the large intestine if a concentrated

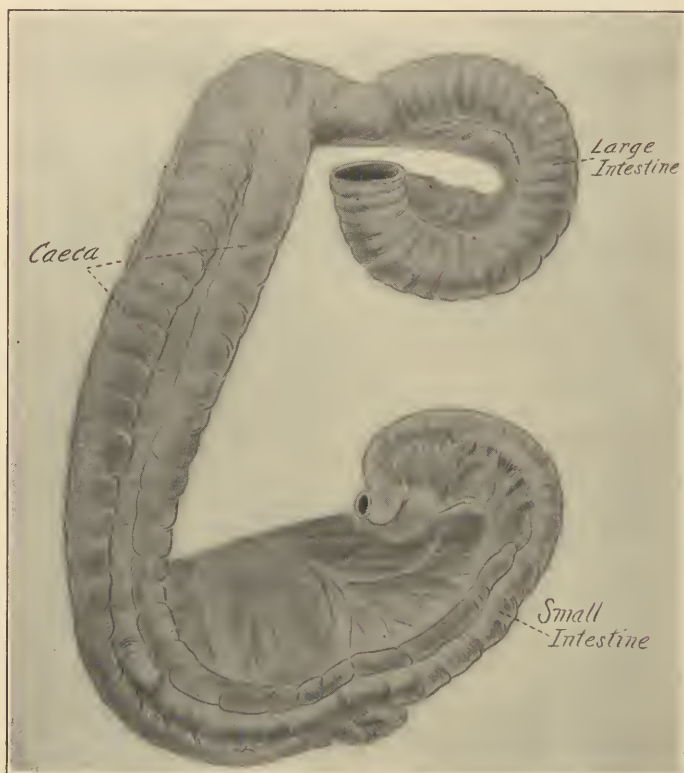


FIG. 58.—ILEOCOLIC JUNCTION AND CECA OF OSTRICH. (Redrawn from Huntington.)

diet is used, but inasmuch as a mixed diet is found best for man, it is much better to preserve this function, which is performed by the cecum.

Cannon,² of Boston, who has probably added more reliable data concerning the physiology of the cecum than anyone else, in studying the physiology of the large intestine, states that the cecum and the ascending colon contain a stagnant mixture of undigestible matter, food, cellulose, water and bacteria, which would seem to present an ideal condition for putrefaction and decomposition. He asserts that in the cecum and the ascending colon the last of the food disappears and the water is largely absorbed, which causes the

² *Journ. Am. Med. Assoc.*, July 6, 1912.

waste to become gradually more dense. He says that while the contents of the cecum and ascending colon are soft and mushy, the contents of the transverse colon may be found as firm as that which is discharged through the rectum.

Barclay Smith finds that the digestive changes of food within the large bowel are due to the action of bacteria which have a permanent abode in the cecum, and that the purpose of the *ileocecal valve* is to prevent the contents of the cecum and colon, which are undergoing bacterial digestion, from being forced by antiperistaltic movements into the ileum, where a totally different digestion is in progress.

A. E. Barclay³ in a statement concerning X-ray findings has the following to say:

"The *ileocecal valve* has been very carefully studied by Case, Hertz, Cole and others, by means of opaque enemata, and, apparently, it should normally be quite resistant to the injection; no leakage should take place into the ileum. In 16 per cent of cases, however, it is found that the injection does pass through to some extent, that is, the valvular action is incompetent. In one of my own cases, I saw an injection flow quite freely, not only into the ileum, but also into the jejunum; some of it I actually located in the duodenum. Case states that when this phenomenon is noted radioscopically, the incompetence can be confirmed at the operation by 'milking' the food or air in either direction, and Kellogg has devised an operation for the repair of the valve or the formation of a new one. As a cause of ileal stasis this defect is well worthy of consideration, and Cole asks if it is likely that the small intestine will tolerate regurgitated fecal matter without giving rise to symptoms of some kind, probably referred to the stomach. This incompetency of the ileocecal valve is probably the explanation of the fact that patients sometimes state that they can taste a soap enema. A patient is stated to have actually vomited a part of an oil enema within half an hour."

There is much to be said in favor of the importance of the ileocecal valve, when we note in true stasis cases that the ileum is very much dilated following ileosigmoidostomy, either with or without exclusion, which indicates that intra-intestinal pressure is greater in the large intestine than in the small (see X-ray pictures in Fig. 46A and B). Barclay Smith believes, with Lane, that the modern diet is so concentrated and well prepared that no bacterial digestion is necessary, and that, therefore, the large intestine is not necessary. He observes that the preservation of a part of the cecal and colic contents is essential for the digestive economy of vegetable-feeding mammals, and if we admit that the digestive processes of the cecum and colon result from the action of certain bacteria, we see why nature has placed the proximal part of the colon outside of the influence of the expulsive mechanism. He says that in the proximal part of the colon, antiperistaltic retaining movements are observed and never the movements of complete expulsion, and also makes the interesting observation that the

³ *Brit. Journ. Surg.*, 2:638.

peculiarly strong stomachic digestion of fishes and the absence of a large intestine, and, therefore, the absence of gas formation, is nature's provision for preserving the equilibrium of the fishes in water. He points out that if it were necessary for a fish to have a large intestine with bacterial digestion, such as a mammal, and particularly a vegetarian, the gas formed thereby would completely upset the equilibrium of the fish.

The cecum in herbivorous animals always contains fecal matter and gas no matter how long the animal is starved, and this fecal matter is made up largely of bacteria, which seem to play an important part in completing intestinal digestion. The cecum seems to retain by antiperistalsis enough food to keep the bacteria alive during intervals of digestion. This active bacterial life is found mostly in herbivora and is essential to the animal's very existence. This seems to act very much on the same principle as the septic tank, which, when properly constructed and not disturbed, destroys sewage entirely so that the water draining away from it is colorless and odorless. If the septic tank is not properly constructed, or if the bacterial growth is disturbed by agitation or by chemical antiseptics, the water flowing from the tank is not clear and has an odor. It is well known that bacteria, like animals, are unable to thrive in the presence of their own offal. If there is too little or too much water flowing through the septic tank, the bacterial equilibrium is upset and the tank does not work perfectly. Therefore, it seems entirely reasonable that pathologic antiperistalsis acts deleteriously not only by holding the intestinal contents in the cecum too long but also by returning the formed fecal matter, made up largely of the offal of the bacteria themselves, destroys them and limits their normal action and thereby creates a swill tank instead of a normal so-called septic tank. Physic or abnormal stimulation of any kind causes too rapid movements and disturbs normal bacterial digestion. It seems that the bacterial digestion taking place in the cecum is for the double purpose of destroying the undigested vegetable matter and thereby preventing putrefactive decomposition into toxic substances, and also, in certain herbivora, for the completion of the preparation of vegetable matter for absorption and use.

CHAPTER VI

MOTILITY OF THE LARGE INTESTINE

Elliot and Barclay Smith¹ have made an important observation concerning the difference in innervation of the large intestine in various animals. They found that in carnivorous animals, such as the cat and the dog, stimulation of the sacrovisceral nerves caused emptying of the large bowel from the cecum to the rectum, while in vegetable-eating animals it extended only to the

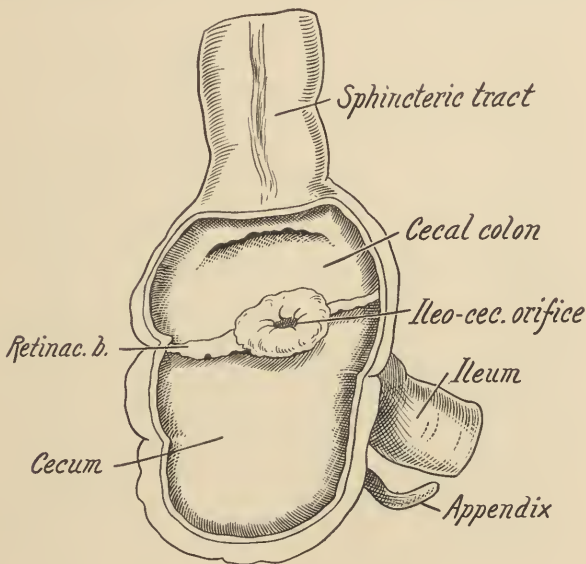


FIG. 59.—THE HUMAN CECUM OPEN. (Keith.)

It shows the ileocecal orifice, the retinacular bands, the cecal colon, and cecocolic sphincteric tract. One-third natural size.

distal part of the colon, not including the cecum and the first part of the transverse colon.

Cannon observed that the anastaltic wave starts in a cat at a tonically constricted ring near the cecum. Boehm describes such a ring in the human being in the transverse colon. Keith believes that he has observed sphincteric action near the middle of the ascending colon (Fig. 59). Keith refers particularly to Auerbach's plexus, which furnishes the terminal filaments of the nerve supply to the large intestine. He calls attention to the fact that there is a tissue between nerve fiber and that of muscle fiber, which has not been named, but which for convenience he names "Auerbach's tissue."

¹ Quoted from Keith's article in the *British Medical Journal*, December 7, 1912.

He found in the rat a ring of ganglionic tissue around the terminal portion of the ileum between the two muscular layers (Fig. 60). This ganglionic mass extended along the anterior and the posterior wall of the ascending colon and cecum for some distance above and below the ileocecal opening. He found in the rat that this ring or mass of tissue controlled the movements of the ileocecal region.

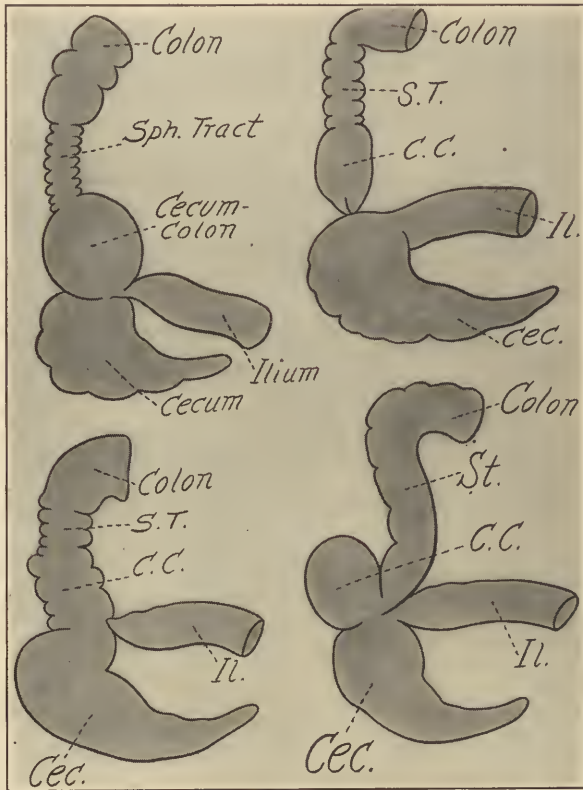


FIG. 60.—FIGURES ILLUSTRATING FOUR FUNCTIONAL STATES OF THE ILEOCECAL REGION OF THE BOWEL OF RATS. (Keith.)

In *A* and *C* the ileocecal sphincter is closed; in *B* and *D* it is relaxed. In *A* and *B* the sphincteric tract is closed; in *C* and *D* it is open. Various conditions of the cecocolic sphincter are shown in *A*, *B*, *C*, and *D*.

Roith² has materially added to the knowledge of the motility of the large intestine by the study of fecal fistulae. In five cases of fistula of the ascending colon he found that feces began to escape from two to four hours after eating. There were two cases with fecal fistula at the center of the transverse colon, following transverse division of the gut in which both ends had been sewed to the skin. Evacuation occurred one, two, or at the most, three times during the twenty-four hours. It usually came on at about the same time each day and lasted only for a short time and was of semisolid character. The same results were shown in sigmoidocolostomy. This is amply

² Mitt. a. d. Grenzgeb. d. Med. u. Chir., Band xxv, Heft 1, S 203.

proved in the practice of every intestinal surgeon. I have noticed that a patient who is constipated before such a colostomy is just as much so afterward. Roith noted the long retention of fecal matter in the first part of the large intestine and the tendency to return the contents into the cecum by antiperistalsis. In three cases of anastomosis of the ileum with the colon close to the hepatic flexure, transportation of the contents into the oral segment of the gut was noticed. In one of them a fecal fistula of a year's standing persisted after implantation of the ileum 20 cm. distal to fistula, but closed spontaneously after a second implantation of the ileum into the



FIG. 61.—DIRECTION OF FECAL CURRENTS AFTER OPERATION.

Diagram showing direction of fecal currents after transplanting severed ileum into the right half of the transverse colon and also into left half and for the curve of long standing fecal fistula of the cecum. (Drawn from verbal description of Roith.) The one operation does not cure the fistula, the other does.

distal half of the transverse colon (Fig. 61). In two other cases fecal fistula of the stump of the colon came on after resection of the cecum and implantation of the ileum 10 cm. beyond the point of resection. In nine cases in which a similar anastomosis was made between the ileum and the left half of the transverse colon, the intestine was left open with the drainage tube sewed into it. When the tube was finally removed, the fistula closed spontaneously. In a case in which the sigmoid had been divided and the two ends brought out through an opening in the abdominal wall, bismuth mixture injected into the rectum ran out upon the skin and covered the opening of the proximal gut. X-ray afterwards showed that a considerable

quantity of this bismuth had been drawn into the upper segment, which was further proved by the fact that the bismuth passed out of the upper segment when the bowels acted. These experiments are borne out almost entirely by the excellent work of Cannon, of this country, and of Keith, of England. Roith concludes that normally there is both peristalsis and antiperistalsis in the region comprising the cecum, the ascending, and the first half of the transverse colon; peristalsis only in the left half of the transverse and in the descending colon; and again both peristalsis and antiperistalsis in the sigmoid and the rectum (Fig. 62). In a certain per cent of badly constipated

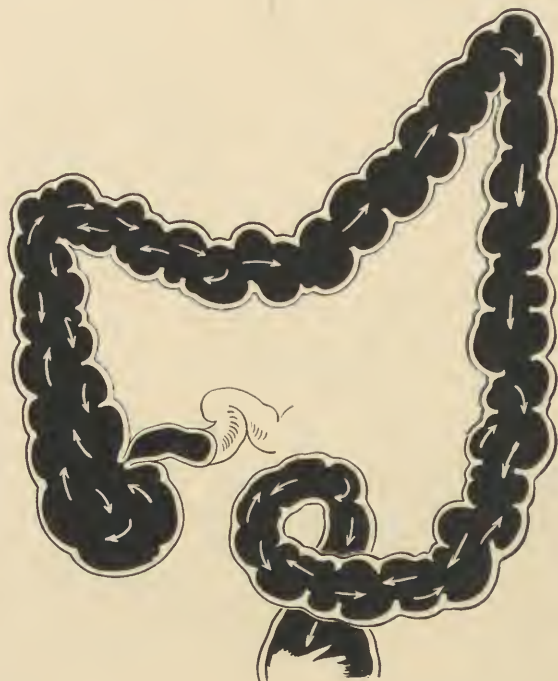


FIG. 62.—DIAGRAM IN WHICH THE ARROWS INDICATE THE NORMAL FECAL CURRENTS.
(Described by Roith.)

patients, antiperistalsis is more marked and may be found along the entire large intestine.

Barclay³ remarks on the extraordinary fact which showed up at the beginning of X-ray observations, that no movement of any kind was seen and yet from time to time it was noted that between two examinations separated by only a few minutes, the head of the column had passed through many inches of the colon. He says Holzknicht was the first to see and describe such an actual movement. It was apparently a sudden movement in mass of the whole column in the colon and took place in some three seconds. Then Hertz took it up and confirmed the findings of Holzknicht. Barclay says that he has seen the actual movement now about ten times and he is

³ *Brit. Journ. Surg.*, 2:646.

absolutely convinced that this is the natural and normal movement. He quotes Jordan, Case and others, and then he has the following to say:

"There is not, so far as I know, any theory, except this of 'mass' movement, that will explain the facts as we see them. All the observers agree that, without subjective sensations of any kind, the haustral segmentation disappears, and the whole mass rushes suddenly—in three seconds, Holzknecht suggested—through a length of colon. In all my cases it happened that the head of the column was in the region of the hepatic flexure, and when the movement finished, the head of the shadow had passed on to the splenic flexure or further. The whole process is over in a very short time, and the haustral segmentation, and general picture of still life, are almost immediately restored. My impression is that the perfectly natural movement is somewhat slower; at any rate it has appeared to be so since I had my patients prepared by purgatives thirty-six hours before the first meal, that is, sixty hours before one expects to observe the large bowel. In one instance I timed the passage from the middle of the transverse colon to the pelvic brim as fifteen seconds; but in all the other cases the passage was so unexpected that it was almost completed before one had time to realize what was happening. The mechanism appears to be: (1) A relaxation of the tonic action of the muscular coats; followed by (2) a big peristaltic wave that sweeps the whole contents along. This movement probably occurs some three or four times a day.

"Incidentally, it is interesting to note that the firm and solid appearance of the colon shadows, both on the plate and also on palpation, is due to the tonic action holding the more or less fluid feces in definite form."

ABNORMAL MOTILITY—CONSTIPATION

In Chapple's paper on the life history of fifty short-circuited patients of Lane's, it is seen that approximately one-third of all the cases thus short-circuited later required removal of the colon on account of overfilling of the cecum by material which was carried up from the anastomosis. Other surgeons have found it necessary to remove the colon in a much larger percentage of short-circuited patients, in order to procure comfort.

In 1906, I reported the first case of short-circuiting for severe intestinal stasis and stercoral ulcers that had been reported in this country—in fact, it was done before I had heard of Lane's work. The patient was temporarily very much improved and was reported as cured, but a year later it was necessary to remove the entire colon, which was found packed full of fecal matter which had backed up.

Some years ago I removed a colon, a year and a half after a short-circuiting operation had been done by a very prominent surgeon of this country. The patient observed that the fecal matter backed into the cecum in large quantities instead of passing through the rectum. A bismuth meal given by us was returned almost entirely into the cecum. The ascending

colon was removed together with half of the transverse colon. At the time of this operation, the short-circuiting operation which had been done a year and a half before was found to have been performed perfectly and there was no obstruction below the anastomosis; the sigmoid was dilated somewhat in a fusiform shape; the ileum was also dilated to approximately the same shape and size as the sigmoid; the cecum, despite all of our efforts to empty it before the operation, contained three or four pounds of fecal matter, and bismuth, which had been given six weeks before by the stomach, was found. After the operation the patient felt decidedly improved and had some diarrhea. Gradually the constipation returned, and the patient again complained of the fecal contents backing up into the stub of the transverse colon—in fact he was just as bad as before the previous removal operation. He insisted on having the remainder of his colon removed down to the anastomosis. At this operation, it was found that the left half of the transverse colon which had been left at the previous operation was packed full of hard fecal matter, just as the cecum and transverse colon had been at the first operation. Since the removal of the colon down to just above the ileosigmoid anastomosis, the patient has felt well, with slight diarrhea at first, and finally, constipation sufficient to require enemas. This is a case of typical hyperrepulsion or reverse peristalsis.

Probably the most persistent form of reverse peristalsis is found in certain cases of gradual obstruction of the rectum or sigmoid by carcinoma. It is quite often found in those cases that the intestine near the growth is not distended at all while the cecum may be distended to enormous proportions, and in some instances the distention is sufficient to cause gangrene, as reported by Anschutz, Kruiter, and Roith. I have personally seen two cases in which gangrene had been actually produced. In addition, I have seen three other cases in which this hyperrepulsion, almost to the point of gangrene of the cecum, has occurred without distention of the colon near the growth (Fig. 63).

By studying with X-ray a number of cases in which we had done an ileosigmoidostomy for other conditions, in which *constipation did not exist before the operation*, we found that reverse peristalsis did not take place and bismuth was not found going back into the cecum, regardless of the technic of the anastomosis.

Keith believes that intestinal stasis and mucous colitis are due to a disturbance of the motor mechanism of the large intestine. As a preliminary in his article he relates his work on rats' intestines, which convinced him of the correctness of his theory. He believes that in many of these cases there is a hypertonicity of the bowel instead of a hypotonicity, and believes with Hertz that the delayed passage of the ileal contents is not due to bands, but to hypertonus of the ileosphincteric tract. He calls attention to the fact that he has never been able to demonstrate an obstruction resulting from a peritoneal band by the X-ray; he believes that Jordan's pictures show a spastic condition, but not an obstruction; that duodenal stasis may be due to a ptotic drag on the superior mesenteric artery.

According to Barclay, Hertz found in observations on students that the average normal times in which food should reach various points were:

Cecum	4½ hours
Hepatic flexure	6½ hours
Splenic flexure	9 hours
Brim of pelvis	11 hours

He calls attention to the fact that these are only average times, and wide differences are possible even in perfectly normal subjects. Barclay referring



FIG. 63.—EXTREME DISTENTION OF THE CECUM WITHOUT DISTENTION OF THE DESCENDING COLON IN GRADUAL OBSTRUCTION OF THE LOWER BOWEL.

to these figures says: "If we accept this 'mass' movement, described by Holtzknecht, occurring some three or four times a day, as the normal, it is evident why these wide variations are possible." He continues the discussion of constipation as follows:

"Constipation has been defined by Hertz and others; but, holding the views I do, I would rather leave out any definition; each case is an individual, and this must not be lost sight of for the sake of making a definition. One sees patients who are always out of health if a daily action is not obtained; while one has also seen health regained when patients have ceased to worry

the intestines into daily actions, and reverted to a habit of twice a week. My own experience in the study of these cases indicates that there are two, and only two, real seats of stagnation in the large intestine (apart from kinks and adhesions), namely, the cecum and the rectum. Of these, the rectal stagnation is the most frequent, and to it Hertz has given the name of dyschesia. It is in reality a fault of defecation rather than a true constipation. In these subjects it is extraordinary to see the way in which the shadows accumulate and form great masses in the rectal ampulla without any call to stool being felt. The rectum is sometimes ballooned out to a great size, and is presumably atonic. When the bowels have been moved one finds that it is only a part of this shadow that has disappeared.

"But in constipation proper, the delay is nearly always in the cecum and ascending colon, and these portions remain filled for days at a time, in spite of the fact that some of the contents may have moved on to various portions of the colon; in other words, there is a defect in the 'mass' movement, a defect not of one part of the colon, but of the mechanism. The position of the head of the shadow is not necessarily an index to the site of the portion of the gut that is responsible for the delay. One believes rather that the constipation is more likely due to some fault in obtaining a more or less fixed point,⁴ or a temporary sphincter at some point, from which to work, than a defect in the movement itself.

"One has never seen, nor are there any records to show, that this movement takes place in the cecum itself. One has often seen movements in the lower part of the cecum of a peristaltic nature, and it is possible that these should be sufficient to raise the food to a position in the ascending colon in which this 'mass' contraction can catch hold and carry the food along. As a result of his researches in comparative anatomy, Keith believes that there is some form of sphincter between the cecum and ascending colon. Possibly, although one sees no radiographic indications of it in the ordinary course of events, there is some sphincter, as he suggests, and its function may be to prevent regurgitation when the 'mass' movement is in progress. In support of this hypothesis there are several observations: one has never seen the cecum empty suddenly between two observations, nor has the 'mass' movement of the shadow been observed to clear out the cecum. On the other hand, one has frequently observed large shadows left in the cecum while the contents of the hepatic flexure and transverse colon have passed far on towards the pelvic colon. Moreover, although the large intestine is always swept clean (except for definite scybala possibly), there are often traces of the opaque meal left in the cecum for days—that is, it is not swept clean.

"This 'mass' theory is so unparalleled in the human body that one hesitates to go any further than this brief suggestion of the normal. One finds widely ballooned colons and greatly narrowed colons—that is, apparently atonic and hypertonic types—and these have been described as the causes of constipation; but I doubt whether they are. Rather, I would suggest, they in-

⁴ A *point d'appui*.

dicate the condition of the colon between the movements, for I happen to have seen the 'mass' movement sweep the shadow along both types of colon, and in both the movement was perfectly effective in displacing the contents. The part played by the cecum is not clear; but if my deductions are correct, this portion of the large gut has a separate mechanism or peristalsis for mixing the contents and feeding them into the ascending colon, preparatory to the occurrence of the 'mass' movement."

Since writing the above, Barclay again writes:

"I have on two occasions noted the formation of a definite constriction—a *point d'appui*—such as I suspected was necessary for the efficiency of the mass movement. In each case it was near the hepatic flexure, and was not evident until this was palpated out with the spoon.⁵ I am not absolutely certain on the point, but believe that the sphincter was formed after palpation of the cecum in the exploration of the appendicular region. In both instances the colon distal to the constriction lost its haustral segmentation, and the contents seemed to back up to the *point d'appui*, as if forming a mass ready to be propelled onwards when the 'mass' movement took place. In both cases a strong 'mass' movement occurred within half an hour, but I did not actually see it. In one instance the whole column on the distal side of the *point d'appui* was swept along; while in the other about half of it was left behind. In the latter case, however, the colon did not look healthy, and, in fact, there was mucous colitis. These two cases are at least distinctly suggestive that my hypothesis is correct, and I am now examining the hepatic flexure both before and after palpation of the cecum in order to obtain more evidence on the point.

"It is too early to make a definite statement, but I am becoming more and more convinced that the keystone to the efficiency of this movement of the large intestine lies in the competence of the *point d'appui*, and that it is on the competence of this temporary sphincter that the natural action of the bowels depends. Inversely, the failure or incompetency of this valve is responsible for the constipation, that is, the ineffectiveness of the 'mass' movement when it takes place. For if there is no *point d'appui* the feces regurgitate into the cecum, possibly giving rise to the sloppy ceca that we recognize and think of as the cause of constipation. Not only so, but in time one would expect this to lead to inefficiency of the ileocecal valve.

"Moreover, if the 'mass' movement is not effective, there is nothing except the comparatively feeble movement of the cecum to propel the food through the large intestine, and when the movements take place, they propel the feces in both directions, that is, the mass in the cecum has to act as an inefficient *point d'appui*."

⁵ "I have now seen the formation of a *point d'appui* in the splenic end of the transverse colon. The haustral segmentations first disappeared, leaving a fat sausage-shaped mass in which a constriction developed after a few minutes. Shortly after the formation of this sphincter, the mass distal to it started and moved comparatively slowly, in about 44 seconds I should say, around the splenic flexure and down to the rectum."—Barclay.

As corroborative evidence of this theory of Barclay's and, furthermore, of the probable truth of Keith's suggestion that there is probably a sphincteric tract at the beginning of the ascending colon, I will relate the following case: The patient was a man, about forty years of age, who came to my associate Dr. Sears suffering from intestinal obstruction which proved to be a carcinoma. On May 20, 1920, I operated for carcinoma of the left half of the transverse colon. At that time most of the transverse colon was removed, practically all of the omentum, most of the transverse mesocolon, including the mesenteric glands. The appendix was removed and the cecum anastomosed with the sigmoid colon. The proximal cut end of the transverse colon was turned in by a purse-string and allowed to remain.

The patient always had trouble afterwards, although the contents of the cecum were delivered into the sigmoid. The condition gradually grew worse. The patient complained, giving symptoms of intestinal obstruction, although the bowels would move. An enlargement gradually developed on the right side of the abdomen with visible peristaltic waves. These waves moved from below upward. Our diagnosis was that a loop of small intestine had probably become strangulated and was partially obstructed, inasmuch as an opaque enema showed by the X-ray that the cecosigmoidostomy opening was good.

On opening we found there was no obstruction of the small intestine; that there was a tremendously dilated ascending colon, up to the first part of the transverse colon, which had been turned in. At first it was quite puzzling to know why all these symptoms. Finally we concluded that the intestine had probably been dilated by peristaltic waves trying to force the contents of the cecum upward in its normal wave against the turned-in end of the colon. We, therefore, decided to remove the ascending colon and the first part of the transverse colon, which had been left at the former operation.

This we did, removing the ascending colon down almost to the ileocecal valve, leaving just enough room for it to empty. We had a large cecosigmoid opening; therefore, we felt it was all right.

This second operation was done on January 22, 1921. The obstructive symptoms have been entirely relieved and we feel our deductions were correct. In leaving the large dead end above the ileocecal valve at the first operation and expecting all the contents of the ascending colon to be delivered backward into the sigmoid, we had made a mistake. The peristaltic waves still continued to act as they did before.

This case indicates that in certain individuals, at least if the fecal contents get by a given point in the ascending colon, the tendency is to drive toward the splenic flexure. It may be that this point is the *point d'appui* referred to by Barclay.

CHAPTER VII

THE RÔLE OF HABIT IN CONSTIPATION

Very few of us realize what an important rôle habit plays in all of our acts. By far the greater part of our work is done without a thought of how it is done. Rarely can a man correctly state the moves he uses to dress himself, or the surgeon to cleanse his hands, or to prepare a field for operation.

We speak of habit. What do we mean by the word "habit?" James says.

"The most complex habits are nothing but concatenated discharges, due to the presence there of a system of reflex paths, so organized as to wake each other up successively, the impression produced by one muscular contraction serving as a stimulus to provoke the next until the final impression inhibits the process and closes the chain. . . . In action grown habitual, which instigates each new muscular contraction to take place in its appointed order, it is not a thought or a perception, but the sensation occasioned by muscular contraction just finished. A strictly voluntary action has to be guided by an idea, perception and volition through its whole course. In a habitual action mere sensation is a sufficient guide, and the upper region of the brain and mind are set comparatively free. In habitual actions the only impulse which the centers of idea or perception need send down is the initial impulse, the command to start."

He further illustrates this point by comparing the formation of habit to water, which "in flowing, hollows out for itself a channel, which grows broader and deeper, and after having ceased to flow, it resumes, when it flows again, the path assumed by itself before. Just so the impressions of outer objects fashion for themselves in the nervous system more and more appropriate paths, and these vital phenomena recur, under similar excitements from without, when they have been interrupted a certain time."

Carpenter says:

"Our nervous system grows to the modes in which it has been exercised."

In another place James refers to Rip Van Winkle, in Joseph Jefferson's play, who always excuses himself every time he is drunk by saying, "I won't count this time."

James says:

"Well, he may not count it, and a kind heaven may not count it, but it is being counted none the less; down among his nerve cells and fibers, the molecules are counting it, registering and storing it up to be used against him when the next temptation comes."

This is true even in the absence of a nervous system. Dumont says:

"By habit a violin used by a master for a number of years acquires beautiful tones because the fibers of the wood at last contract habits of vibration conformed to harmonic relations."

There is probably no other subject pertaining to disease in which habit plays such a conspicuous part as in constipation.

Cannon, in discussing this subject says:

"Inasmuch as defecation is a reflex initiated by the presence of feces in the rectum, it is a matter of much practical importance to know that the rectal mucosa soon becomes adapted to the presence of fecal accumulation and then fails either to induce a desire to defecate or to initiate reflex contraction of the colon. If the call to defecate is not promptly obeyed, it ceases to be given and the feces stagnate in the rectum."

Constipation in animals, if on normal and well-balanced diet, is very rare. This is due partly to the fact that quadrupeds are not surrounded by conventionalism, and, unless trained, always permit the bowels to act when the impulse is given. It is very different with the human. Customs of our society are such that young people in the formative stage are very sensitive and falsely modest on these questions, and rather than let it be known to the opposite sex that these functions are performed, the contents of the bowels or of the bladder are retained at great pain and discomfort. Possibly the next day or some days afterwards the same necessity arises for holding the contents of the bowel. This time it is easier. Next day it is still easier, and as time goes on the sensation is gradually lost. The fecal matter becomes hardened by lying constantly in the bowel, the chemicals that normally stimulate the bowels to act are absorbed, and finally the individual fails to recognize the presence of fecal matter in the lower bowel. As a result it is either lifted back into the cecum and other portions of the colon or remains in the rectum and sigmoid unnoticed.

When I visited Sir W. Arbuthnot Lane, in January, 1912, he expressed his great disappointment that frequently his patients who had been short-circuited, or in whom the colon had been removed, were still very much constipated. Several years ago, I removed the ascending colon and part of the transverse colon, and implanted the ileum low down into the pelvic colon in a patient, for the reason that no ordinary means would produce normal

bowel action. For the first two months after the operation, she had diarrhea, which, however, gradually decreased; then for a few weeks bowel action was satisfactory. After that time she developed constipation practically as severe as before the colon was removed. X-ray pictures taken at this time showed that bismuth went through the small intestine in normal time, a part of it lingering in the ileum for a while, but practically all of it being in the rectum in six hours, where it remained for days without moving up or down, and without producing any sensation. We found that the remedy required, even though she had had an ileosigmoidostomy, was a simple enema. A few months later this case was examined, showing that the bismuth, instead of passing through the rectum, gradually passed into the dead end of the colon above the anastomosis. After these pictures were taken, the remainder of the colon was removed down to the ileosigmoidostomy opening. Severe diarrhea again developed immediately after the operation and continued for several weeks, gradually diminishing and becoming intermittent, at which time the patient felt quite comfortable for a few months. Now the patient is again severely constipated—in fact, is fully as miserable as before any operation was performed. At the time of this second operation, it may be stated that hard lumps of fecal matter were noticed for nearly four feet up the ileum above the anastomosis, although a cathartic had been given beforehand. This is not a case of hyperrepulsion, but of simple, habitual constipation, in which the intestine had ceased to respond to the stimulus of the presence of fecal matter.

CHAPTER VIII

RELATIVE EFFECT OF CONSTANT AND INTERMITTENT OBSTRUCTION

That kinks in the gastro-intestinal tract, found in the ptotic individual, have anything to do with obstructing or retarding the onward flow of the gastro-intestinal contents, has been persistently disputed by many of the leading medical men and surgeons of the world, notwithstanding the fact that practically all of those who have carefully studied the subject agree that such kinks do produce a slowing of the gastro-intestinal contents. The chief reason given by those who dispute the bad effects of such angulations is that in an organic obstruction due either to a growth of a constricting ring or band, the wall of the viscus above the obstruction is always hypertrophied, and its musculature is greatly increased by its effort to overcome the obstruction. On the other hand, in cases of so-called obstruction found in ptotic individuals, the cecum and other portions of the intestinal canal may be widely distended, with walls thin and atonic, and yet on the operating table may show no obstruction. We believe that it is not at all necessary to attempt to refute these well-known and well-established facts. There is one physical fact which has apparently been overlooked. It is that the obstructions produced by angulations of the intestine of the ptotic individual are due entirely to gravity, and are positive only when the individual is in the erect posture—the kinks being relieved as soon as the patient assumes the recumbent posture. The obstruction in the ptotic individual is intermittent, while an organic obstruction is constantly present.

In cases of midline ptosis, we often find a patient whose fat has been absorbed and whose stomach is down in the middle, dragging from its two fixed points, namely, the second portion of the duodenum and the oesophagus. In such a case we often have a stomach which does not empty in normal time, the contents of which become very foul and excessively acid, producing eructation of sour gas, and discomfort very similar to an organic obstruction. The same thing is true of the colon in midline ptosis with both of the flexures firmly fixed and the transverse colon prolapsed. The cecum, as well as the transverse colon, becomes dilated. Such patients when put to bed on forced feeding and bowel regulation diet are very soon relieved of their obstruction and the stomach and intestines rapidly come to normal. The reason for this phenomenon may be a purely physical one. The second fixed point of the stomach, which is at the second portion of the duodenum, is suspended by its firm supports located here, just as if a soft, flexible tube were hung over a nail on the wall. If the stomach were in this condition a perfectly lifeless

organ, and if we were dealing purely with mechanical conditions, the greater the weight of the organ the greater the collapse of the tube at this point. This collapse, in the case of the bowel, is relieved as soon as the patient lies down. The matter of holding the contents without effort in these lazy, dilated, atonic stomachs until a suitable regularly established time for emptying arrives, becomes a habit with the muscles of the stomach, and but little effort is made to empty it until this favorable time comes. In other words, the tolerance to the presence of food may be established, which is often acquired to a degree that permits a large dilation of the stomach or the large intestine, as the case may be. This is more particularly true if intra-abdominal pressure has been reduced by loss of fat.

The types of bands described by Lane can only have a relation to intestinal stasis when they tend to hold up a ptotic organ. The type of band which Dr. C. H. Mayo described as producing Lane's kink and which holds the small intestine down to the side of the pelvis, and which I personally thought was very important at first, has not, in my experience, proved very important. Such bands we cannot detect by the X-ray, and they probably have very little to do with the production of intestinal stasis. It is probable that these bands are chiefly congenital or inflammatory and are not the acquired bands which have been laid down by the crystallization of lines of force in response to a drag by the weight of a prolapsed organ. Bands which have developed for the purpose of holding up the abnormally movable intestine, if limited in area of attachment, may form a sharp suspending point which may produce intermittent obstruction, such as is produced in the stomach and intestine, as just related. One of the best illustrations of this type of band is the shortening of the mesentery of the ileum about four inches from the ileocecal valve producing a fixed point and forming one side of the parallelogram of forces described by Lane (Figs. 66 and 90). Acquired bands which web the transverse colon to the ascending and descending colon, as described by Pilcher, Lane, and by the writer (Fig. 142), as early as 1902, are of some importance in making a ptosis permanent.

We shall see later in the clinical discussion of this subject that one of the principal diagnostic and prognostic points is that the patient who is constipated as a result of ptosis finds relief from the constipation on going to bed, with the proper diet, while a patient whose constipation is due to habit or possibly to other forms of defective or erratic motility is not relieved and is often made worse on going to bed.

CHAPTER IX

ACQUIRED OR POSTNATAL DEVELOPMENTAL PROCESSES

A child born with an ascending and descending colon which has not normally fused with the parietal peritoneum possesses the potential elements for the development of the ptotic adult (by which we mean a patient with prolapsed ascending and descending colon, with movable kidneys) and in which the characteristic and well-known body habit of such patients exists. This condition is called "enteroptosis." Such a condition cannot develop when normal prenatal peritoneal fusions have taken place and may, therefore, be called "congenital abdominal ptosis."

Longyear has written a very lucid monograph¹ on "Nephrocoloptosis" in which he describes a bundle of fibrous tissue back of the colon which he claims connects the kidney with the posterior surface of the ascending and the descending colon. He believes, and has given good evidence to show, that the floating kidney is pulled out of position by the weight of the colon, which agrees with Glenard's original statement, "Enteroptosis without nephroptosis, but never nephroptosis without enteroptosis." The idea of the importance of the nephrocolic ligament was suggested to him by the following case:

"The operation referred to took place at the Solvay Hospital, Delray, Michigan, December 3, 1903. The patient, a girl of sixteen years of age, had complained more or less of constant pain in the region of McBurney's point and increasingly obstinate constipation for over a year. After a thorough examination (no radiograph), in which everything was negative, excepting a sensitive area in the supposed location of the cecum and appendix, appendectomy was decided upon. At the operation, the cecum, with the appendix deformed by adhesions to itself, was found in the bottom of the pelvic cavity. During the manipulation it was noted that the right kidney could be pulled well down into the abdomen by making traction on the cecum and, moreover, could be held in the prolapsed position by continuing the traction, so that it was impossible to return it to its normal position by counter-pressure with the finger inside the abdomen. On removal of the traction, however, the kidney quickly slipped up to its normal position. These observations led to investigations on both the cadaver and the living subject, with the object of ascertaining what connection there could be between the gut and kidney that was strong enough to give such a manifestation. The result was the isolation of the tissue, which I call the nephrocolic ligament, as the only

¹ Published by C. U. Mosby & Co. of St. Louis, Mo.

union between the gut and kidney which was strong and inelastic enough to cause the kidney to be so readily pulled down.

"This girl's constipation continued to increase, and one year after the appendectomy, reasoning from my previous observations, I concluded that the torpidity of the bowel was due to the low position of the cecum, and made a nephrocolopexy, solely to relieve the constipation. The operation was a marked success, and has continued to be so up to a very recent date (October 17, 1908). At this operation the nephrocolic ligament was found

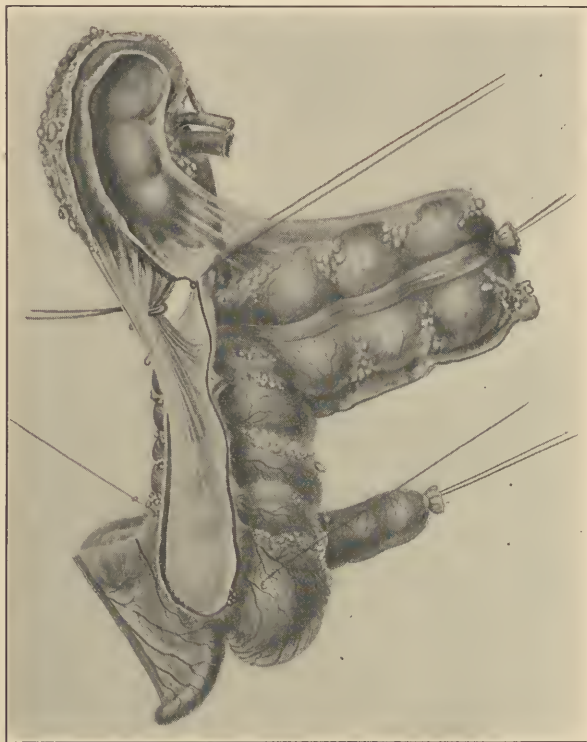


FIG. 64.—LIGAMENTUM NEPHROCOLICUM. (Longyear.)

This illustrates the location of the nephrocolic ligament, showing the right kidney attached to the colon and cecum by the peritoneum and the nephrocolic ligament. The peritoneum has been drawn aside with a cord, and the nephrocolic ligament is shown isolated and drawn away from the gut by the author's forceps hook. The cecum has been turned half around in order to show the insertion of the nephrocolic ligament, the ileum being turned under the cecum.

to be long and lax, which accounted for the kidney remaining in place with such a marked coloptosis" (Fig. 64).

As far as I know, this was one of the earliest, if not the earliest, of intelligent suggestions as to the nature of what we now classify as "right-sided ptosis."

Longyear quotes Reed, of Cincinnati, and Zukerkandle, who contend that the fibers of this ligament are inflammatory. He also makes the following statement:

"Billington's observation that this condition is peculiar to cases of nephroptosis coincides with that of the author, and seems to cover a valuable point in the anatomic experience of some others who, failing to find the ligament as described, base their opinions on the examination of subjects who have had no displacement of the kidney."

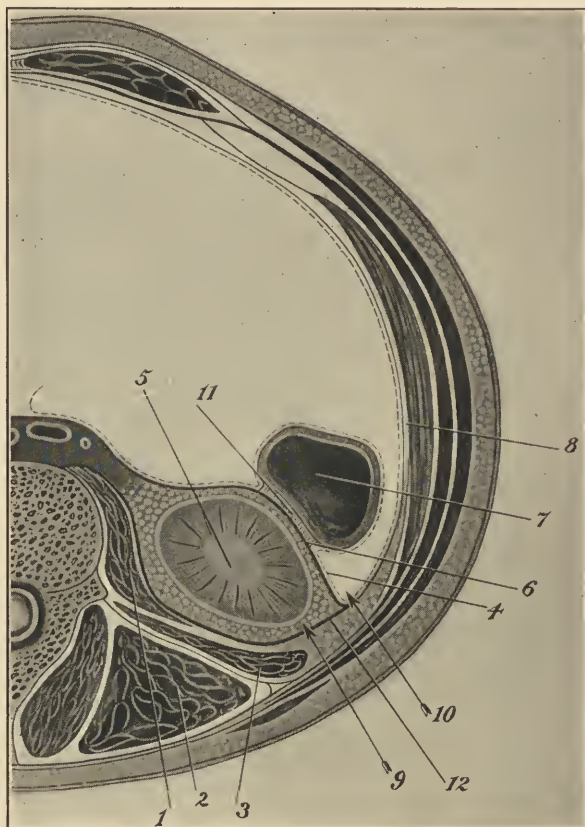


FIG. 65.—TRANSVERSE SECTION SHOWING THE RELATIONS OF GEROTA'S CAPSULE AND THE NEPHROCOLIC LIGAMENT. (Longyear.) (After Gerota, with supplemental notations.)

- | | |
|--|---|
| <p>1. Psoas muscle.
 2. Body of the sacrolumbalis muscle.
 3. Quadratus lumborum muscle.
 4. Peritoneum (dotted line).
 5. Kidney.
 6. Anterior lamella of Gerota's capsule (becoming attenuated as it passes downward and merges with the nephrocolic ligament).
 7. Colon.
 8. Subperitoneal fascia.</p> | <p>9. Proper point of entrance to Gerota's capsule in the operation of nephrocolopexy (close to quadratus lumborum muscle, and just below the twelfth rib).
 10. Improper point of entrance in the operation of nephrocolopexy (peritoneal cavity, and not Gerota's capsule, will be entered).
 11. Nephrocolic ligament.
 12. Posterior lamella of Gerota's capsule.</p> |
|--|---|

Thus, Longyear himself practically admits that the ligament does not exist in a perfectly normal individual. In his monograph he uses a picture which illustrates the relation of Gerota's capsule and the nephrocolic ligament (Fig. 65), and shows a colon attached to the front surface of the kidney by the nephrocolic ligament. The colon has not fused with the parietal peri-

toneum over beyond the kidney, therefore is not normally fixed, as we have shown by the previous studies in embryology and anatomy. It is very clear that Longyear's illustration is taken from such a case as we have described as the second type of nonfusion, and, therefore, does not represent a normal subject. Longyear's nephrocolic ligament, therefore, is without doubt an acquired or postnatal developmental process due to the laying down of crystallized supports in the form of strong fibrous connective tissue in response to the drag of the colon on its attachment to the kidney; corresponding to the acquired membrane described later in this chapter by Lane, except that in Longyear's ligament, the crystallization takes place back of the peritoneum rather than in front of it. Longyear also frequently refers to the hepato-duodenal and hepatocolic ligaments, and gives a lucid description of the mechanism of right-sided ptosis, which practically all students agree affects not only the colon and kidney but also the duodenum, bile ducts and pancreas. Longyear's description of what actually occurs in right-sided ptosis has scarcely been excelled in any publication, but he fails entirely to carry the reader back to the prenatal fusions, in which all authorities of embryology agree, and upon which the beautiful chain of clinical pathology which he has constructed must necessarily rest. While Longyear has thus failed to reach the fundamental underlying cause of ptosis, he has given us one of the most clear-cut illustrations of the evil effects of a mobile ascending and descending colon that has yet been given. Longyear has furthermore failed to grasp the importance of the shape and poise of the abdominal cavity. He also has failed to emphasize the importance of intra-abdominal pressure; but so accurate has been his observation of the clinical appearance of the case that he has evolved one of the most complete and effectual systems of therapy yet brought out.

Sir W. Arbuthnot Lane, whose brilliant and startling work has attracted more world-wide attention than any one who has written on the subject of gastro-intestinal stasis, bases his theory of the relation of ptosis and gastro-intestinal stasis on what he terms the law of the crystallization of lines of force, which theory he developed from the study of the skeleton in the dissecting room in the years prior to 1887, and from which studies he formulated the three following laws:

"1. That pressure produces changes in the structure and form of the bones and in the form and function of existing joints, while it determines the formation of new joints.

"2. That strain produces changes in the form of the bones, and in the form and function of existing joints, and also produces new joints.

"3. That when, apart from the exercise of pressure or strain, it is important, from the altered mechanical relationship of the individual to his surroundings, that a mechanism should be modified or an entirely new one developed, such a change takes place."

He then calls attention to various occupational evolutionary changes in the skeleton and shows how the spine and thorax of a brewer's drayman

becomes curved in such a manner that the barrel of beer practically rests on a shoulder of bone formed by the curved spine; how an arthrodial joint develops in the lumbar spine of the laborer who lifts weights from the ground; how the last lumbar vertebra is dislocated backward on the sacrum in the laborer who carries loads in front of him; how the spine becomes curved in the laborer who carries loads on the head; how a new joint forms in the neighborhood of the atlas and axis in the shoemaker; how shoulders of bone form in the neighborhood of the coal-trimmer's joints, whose motions are limited to a few very definite movements, these shoulders of bone so encroaching upon the joints that it finally becomes impossible for the laborer to move them beyond these accustomed degrees of motion. He then attempts to apply these rules or laws to abdominal ptosis and gastro-intestinal stasis. He bases his entire theory of gastro-intestinal stasis on the question of evolutionary bands which have been called forth or laid down in response to nature's efforts to hold up the abdominal organs with the subject in the erect posture. He, seemingly, would lead the reader to the assumption that all mankind is born with perfectly mobile abdominal organs and all have mesenteries like those found in the quadruped. He ignores, and even ridicules, the theory of prenatal adhesion and fusion, which has been proven to the entire satisfaction of most embryologists and anatomists, and which is said to exist in 80 per cent of normal infants at birth. The reader is left to assume that the flexures of the colon are drawn up by evolutionary bands that have developed after birth, and he makes the statement that the earliest of these evolutionary bands is found in the neighborhood of the sigmoid, and is often developed as early as the second year after birth. He describes the cecum as a large, pendulous bag with a mesentery, which the reader is left to infer is the normal cecum, and shows how, in certain instances, these lines attempt to hold it up by a parallelogram of forces. In certain instances the outer limb of the parallelogram of forces is manifested in bands which seize the appendix and hold it from that side, while the inner limb of the parallelogram of forces is manifested by adhesions which shorten the mesentery of the ileum and hold this pendulous cecum from the other side. In some instances the appendix points toward the median line in these cases and has been caught up by the bands and forms the inner limb of the parallelogram of forces. The picture he describes is a very definite reality and has been seen by me on more than one occasion.

Lane refers to what has been considered the normal fixation of the second part of the colon at the hepatic flexure as belonging to his classification of secondary evolutionary bands, and contends that the condition which we have denominated as midline ptosis is due to contractions of bands at these flexures, which become shorter as time goes on, thus making the flexures much sharper, instead of the belief that the flexures remain permanent at their normal points of fixation and the organs drop lower. Lane also refers to the folds in the neighborhood of the jejunum as secondary evolutionary bands, developed in response to a drag on this part of the intestine by a loaded ileum.

It is without doubt true that Lane's pictures of the evils and far-reaching consequences of intestinal stasis are tremendously overdrawn and it is probably true that his teaching has been the cause of some harmful surgery. It is equally true that there is something very important connected with the subject, that beyond any doubt intestinal toxemia is one of the important causes of disease and the distress which afflicts mankind. Lane, more than all others combined, has in stentorian tones sounded the alarm and called the attention of the people to this phase of practice. Being fearless and having a great personality, he has carried conviction and has caused even the most lethargic to arise and think. Lane's observations have been so extensive and are so susceptible of proof in most instances that I quote from his article published in the *Proceedings of the Royal Society of Medicine*, No. 5, Vol. VI, March, 1913, setting forth briefly some of the principles which form the basis of his work.

"In civilization the trunk is retained in a vertical position during the entire daytime, the reclining posture being assumed only at night. Even then the horizontal posture is modified in character from that normally assumed in savage life. The resting posture of the trunk is the prone position, which is that which is naturally assumed in sleep upon the ground. While in the erect position of the trunk all the viscera tend to displace downward toward or into the true pelvis, in the prone position the tendency is for them to fall upwards and forwards out of or in a direction away from it. If these attitudes were assumed in a normal association the structures in the abdomen would retain their normal relationship to the abdominal wall and to one another. If, however, the attitude of activity is not compensated for sufficiently by the corresponding resting posture, changes will certainly take place, varying in degree with the failure of compensation. It is now our business to study in detail the changes which arise in the several abdominal structures in consequence of this. The portion which is affected in the first instance is our drainage scheme, or, as it is commonly described, the gastrointestinal tract.

"The large intestine forms the cesspool of this tract. As it retains its contents for a comparatively long time, and as most of these contents are of a solid consistence, it is natural that by its weight and situation it should tend to become displaced earlier in the lifetime of the individual.

"In the erect posture the cecum and ascending colon become filled with more or less fluid contents, and by exerting a hydraulic pressure on the cecum tend to tire out its muscular wall and dilate its cavity. By the same means there is a tendency for the dilated cecum to be displaced downward into the true pelvis, where its presence is detrimental to the true comfort and functioning of the viscera, to which that space normally belongs.

"This tendency to displacement in the cecum in a downward and inward direction may be regarded as acting along the resultant of a parallelogram of forces, and, to oppose this tendency, resistances develop which correspond in position and action to the sides of the parallelogram. These lines of

resistance are crystallized first as bands, and later as distinct membranes, which, as the outer limbs of the parallelogram, connect the peritoneum lining the abdominal wall to the outer surface of the colon in its immediate vicinity. A larger area of abdominal peritoneum and of colon is gradually involved, and later still, as is the case in all resistances which are crystallized in peritoneum, the bands are replaced by a layer of peritoneum which clings and tends to support the colon from the outside. As these bands and membranes develop, blood-vessels form in them which later may become sufficiently large to require to be ligatured if divided. This particular resistance, when fully developed into a membrane, has recently been termed 'Jackson's membrane,' and the manner in which it should be dealt with has afforded surgeons an excuse for doing many operations whose object is not very apparent, and which suggest ignorance of the factors determining its development as well as of its function. These crystallized resistances of peritoneum are not limited to the cecum, but may extend up along the outer aspect of the ascending colon, even to the hepatic flexure.

"At this flexure a number of new bands are formed overlying the normal peritoneum and attaching the flexure. These bands as they develop drag the flexure upwards, and in some cases produce a distinct obstruction.

"The bands or membranes are liable to constrict the lumen of the ascending colon usually at the level of the crest of the ileum.

"The inner limb of the parallelogram of forces is represented at an early period by opaque streaks on the under surface of the mesentery, attaching the last few inches of the ileum, and commencing at its base at a point most distant from the bowel. The reason of this development is obvious. Besides retaining the end of the ileum in position, the mesentery assists through the medium of the termination of the small intestine in holding up the cecum and in tending to oppose its downward displacement.

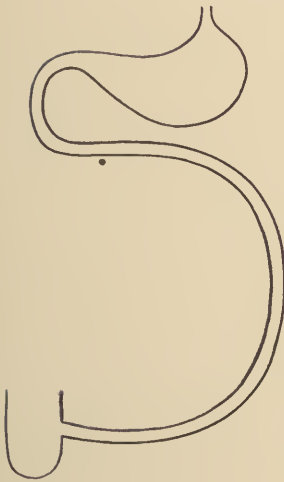
"The thickening in the under surface of the mesentery becomes more distinct, and later develops into a membrane which extends to, and secures, the under surface of the circumference of the ileum, and gradually creeps around it till it reaches that portion of the circumference immediately opposite the attachment of the mesentery. As it extends around the ileum, it also contracts, with the result that it twists the ileum on itself along its longitudinal axis. In its earliest development, as is the case with most conditions which evolve during the lifetime of an individual, because of a variation from the normal in the relationship to his environment, the effect of this acquired ligament or mesentery is useful and physiological, but later, when it kinks and obstructs the lumen of the ileum, it exerts a progressively deleterious effect on the well-being of the individual."

In Figs. 66 to 76 inclusive, Lane has set forth very graphically but simply his idea of the mechanism of what he terms acquired bands. In Figs. 77, 78 and 79, he calls attention to the various secondary developments in the sigmoid which are explained in the legends.



66

FIG. 66.—REPRESENTS THE DISTENDED LOADED BOWEL DRAGGING UPON THE RESISTANCES EVOLVED TO OPPOSE ITS DOWNWARD DISPLACEMENT INTO THE TRUE PELVIS. (Lane.)



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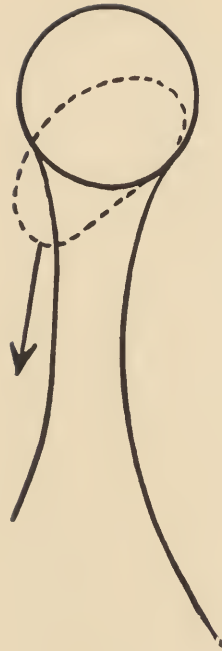
FIG. 67.—DIAGRAM REPRESENTS THE ANCHORED PORTION OF ILEUM WITH ITS MESENTERY IN AN ANTEROPOSTERIOR PLANE. (Lane.)

The resistances external to the cecum are indicated as arrows showing the general direction of the strain exerted by bands, adhesions, and omental structures. The lowest of these secures the appendix, which in these circumstances is kinked. The effect exerted upon the ileum at its point of fixation by the weight of the loaded cecum on its proximal aspect is figured in the diagram.

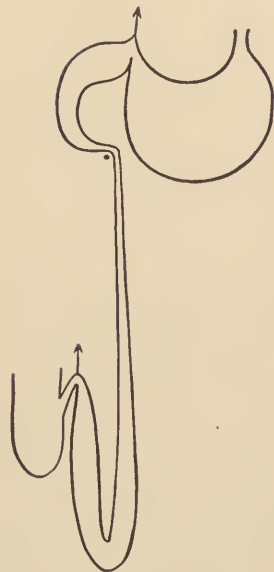
FIG. 68.—DIAGRAM SHOWING THE NORMAL UNOBSTRUCTED CONDITION OF THE SMALL INTESTINE. (Lane.)

FIG. 69.—DIAGRAM ILLUSTRATES THE EFFECT OF THE SHORTENING OF THE UNDER SURFACE OF THE MESENTERY OF THE ILEUM BY ACQUIRED LINES OF RESISTANCE. (Lane.)

This also shows the effect of the loaded ileum on the attachment of the first part of the jejunum.



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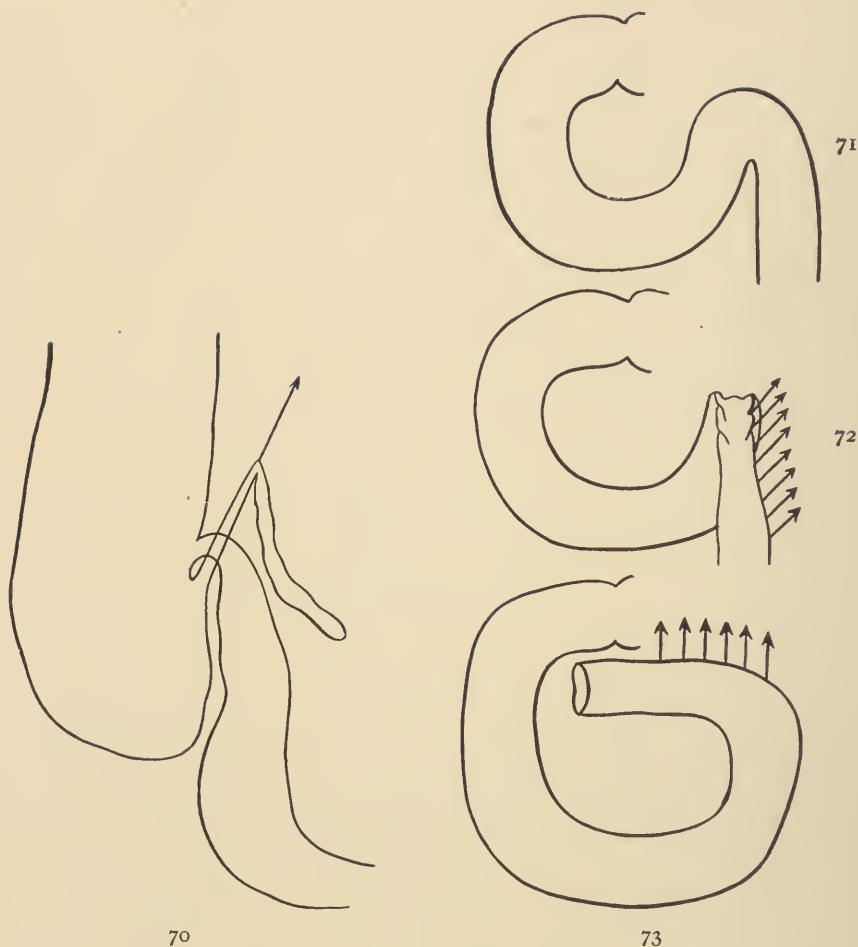


FIG. 70.—MECHANISM OF THE APPENDICAL TIE OR ACQUIRED RESISTANCE WHEN THE APPENDIX FORMS THE INNER LIMB OF THE PARALLELOGRAM OF FORCES. (Lane.)

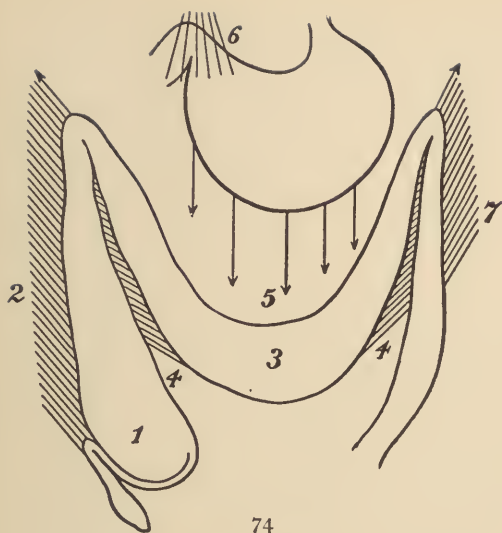
The appendix is secured by an acquired membrane or crystallized resistance represented by the arrow. The cecum and ileal loop are both distended with fecal contents and have fallen into the true pelvis.

FIG. 71.—DUODENUM USUALLY TERMINATES VERTICALLY AT THE ROOT OF THE TRANSVERSE MESOCOLON WHERE IT IS CONTINUED INTO THE JEJUNUM AS A GENTLE CURVE. (Lane.)

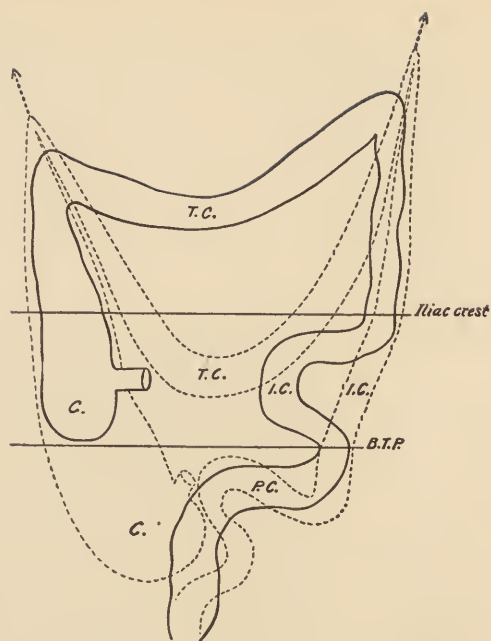
FIG. 72.—A KINKED AND FILLED ILEUM DRAGS ON THE JEJUNUM AND DEVELOPS AN OBSTRUCTION OF THE DUODENAL OUTLET IN THE FORM OF RESISTANCES WHICH ARE LAID DOWN AS PERITONEAL BANDS INDICATED BY ARROWS. (Lane.)

FIG. 73.—DIAGRAM SHOWS RESISTANCES IN THE FORM OF MEMBRANES WHICH FIX THE JEJUNAL LOOP SO AS TO AVOID KINKING. (Lane.)

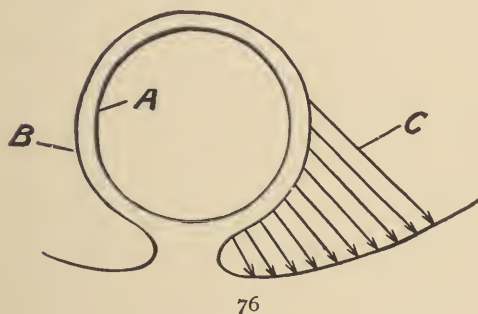
Nature sometimes avoids angulation and strain on the duodenojejunal junction by developing these resistances. The jejunum thus becomes secured from left to right to the under surface of the transverse mesocolon by peritoneal bands or membranes. (This is the ordinary membrane frequently discovered in doing a gastro-enterostomy and which in some instances it is necessary to cut in order to make a successful short loop in doing gastro-enterostomy.)



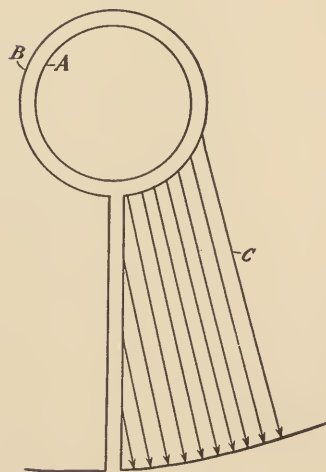
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76



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FIG. 74.—1, represents the prolapsed cecum; 2 and 7, the crystallized resistances which tend to oppose the downward displacement of the large bowel and sustain some of the weight of the transverse colon transmitted through the crystallized resistances 4; 3, the transverse colon; 5, portion of the weight of the transverse colon transmitted through the great omentum to the convexity of the stomach; and 6, the acquired ligament that secures the duodenum and pylorus to the under surface of the liver and gall-bladder. (Lane.)

FIG. 75.—REPRESENTS THE SEVERAL VARIATIONS FROM THE NORMAL WHICH THE LARGE BOWEL UNDERGOES. (Lane.)

The normal condition is shown as a firm outline, and the altered condition as a dotted outline. Note the prolapse of the cecum and transverse colon, the telescoping of the iliac colon and the elongation of the pelvic colon. B, T, P indicates the brim of the true pelvis. The hepatic and splenic flexures are drawn up and kinked by the development of acquired resistances shown as arrows.

FIG. 76.—THE DESCENDING COLON FIXED IN THE SAME MANNER AS THE ASCENDING COLON BY CRYSTALLIZED RESISTANCES. (Lane.)

Transverse section seen from above. A, muscular and mucous coats. B, peritoneum. C, direction of adhesions or acquired resistances.

FIG. 77.—A CROSS-SECTION THROUGH THE SIGMOID AND MESOSIGMOID. (Lane.)

This illustrates the direction and line of traction of the acquired bands. A, muscular and mucous coats. B, peritoneum. C, direction of adhesions or acquired resistances.

Axtell, of Bellingham, Washington, has for a long time laid a great deal of stress on the importance of this last sigmoid kink, and contends that it is very important in connection with intestinal stasis or constipation. His idea is expressed in Fig. 80. He says the symptoms are as follows:

"Sigmoid constipation as outlined in this paper is insidious and very slow of development. The attention of the practitioner is seldom called to the condition until the patient has had recourse to all kinds of nostrums and

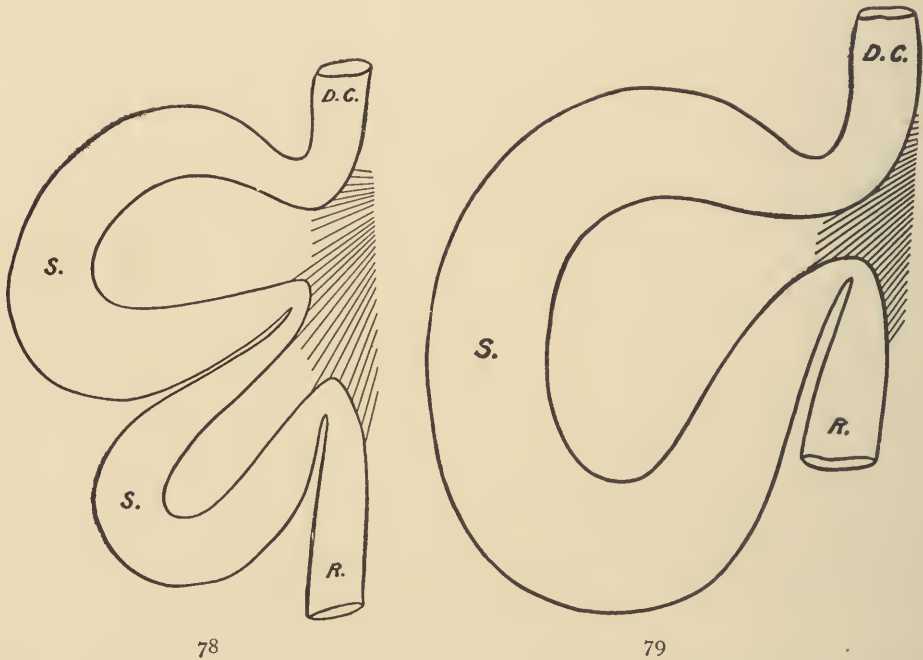


FIG. 78.—IRREGULARLY CONTRACTED RESISTANCES OR MEMBRANES SHOWING DOUBLE KINKING OF THE SIGMOID. (Lane.)

DC, descending colon. *S*, sigmoid. *R*, rectum. Radiating lines, acquired resistances.

FIG. 79.—VOLVULUS OF THE ILIAC COLON AT THE JUNCTION OF THE SIGMOID AND RECTUM. (Lane.)

DC, descending colon. *S*, sigmoid. *R*, rectum. Radiating lines show acquired adhesions or resistances which produce the fixation and kinking of the colon.

enemas and finds that, in spite of all treatment, the condition gradually grows worse. The first thing that calls attention to it is the increased and persistent flatulence, increased discomfort from pressure and sometimes a frequent desire for stool. At the time of stool there is an urgent desire but small, imperfect results. The relief obtained is not that feeling of well-being and comfort that comes from a normal, healthy ejection. There is a constant pressure and a feeling as if there were still more to come away. Continued effort only increases the discomfort and the difficulty.

"Digital examination reveals the empty rectal vault and a boggy mass alongside of the rectum. Sigmoidoscopic examination reveals, as a rule, the

rectum empty and, when the sigmoid is approached, instead of gliding over the folds of Houston and dropping into the sigmoid, the end of the instrument impinges on the wall at the angle as a complete barrier. If by any means the angle can be rounded, beyond is seen only a loop of the sigmoid packed with dry fecal material. There is constantly present tympanitis, and usually tenderness over the cecum."

This description by Axtell forms a graphic, clinical picture of the sigmoid kink set forth by Lane. I concede that the observations of Lane, as to

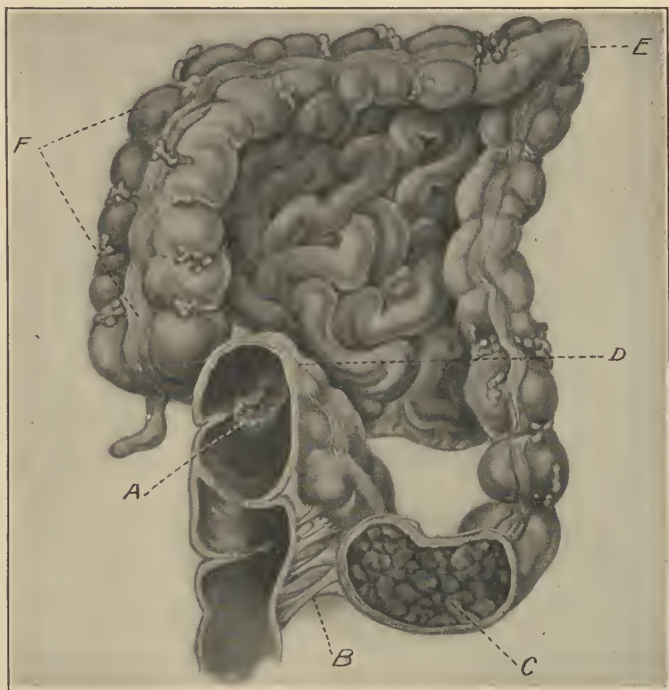


FIG. 80.—IMPORTANCE OF LAST SIGMOID KINK IN CONNECTION WITH INTESTINAL STASIS OR CONSTIPATION. (Axtell.)

A, ulceration. *B*, adhesions. *C*, impacted and prolapsed sigmoid. *D*, acute angulation at rectosigmoidal juncture. *E*, angulation at splenic flexure. *F*, enlarged and distended cecum.

these various secondary changes, are very instructive and accurate. In making this statement, however, I do so with the full belief that the pathology he describes rarely occurs except in those cases having deficient prenatal peritoneal fusion. I believe he has here overlooked the most fundamental point connected with this subject. I am heartily in accord with his law of crystallization of the lines of force and believe that these lines are crystallized when and where they are needed. But these membranes and bands will not develop under this law where normal prenatal fixation has taken place for the simple reason that they are not needed.

In Chapter III, we have learned that normally the ascending and descending colon should be fused with the parietal peritoneum in a way

which practically fixes the intestine. This intestine is fixed on a shelf at an angle of fifty-one degrees. If we were dealing with a mechanical vessel in normal atmospheric pressure, 30 per cent of the weight of a rolling object would be taken up by being placed on a slope rather than suspended (Fig. 81).

Defects in Prenatal Peritoneal Fusion.—Anatomists and embryologists inform us that from 20 to 40 per cent of individuals have not had this normal development. In such individuals, the large intestine, particularly on the right side, has a mesentery more or less like the arrange-

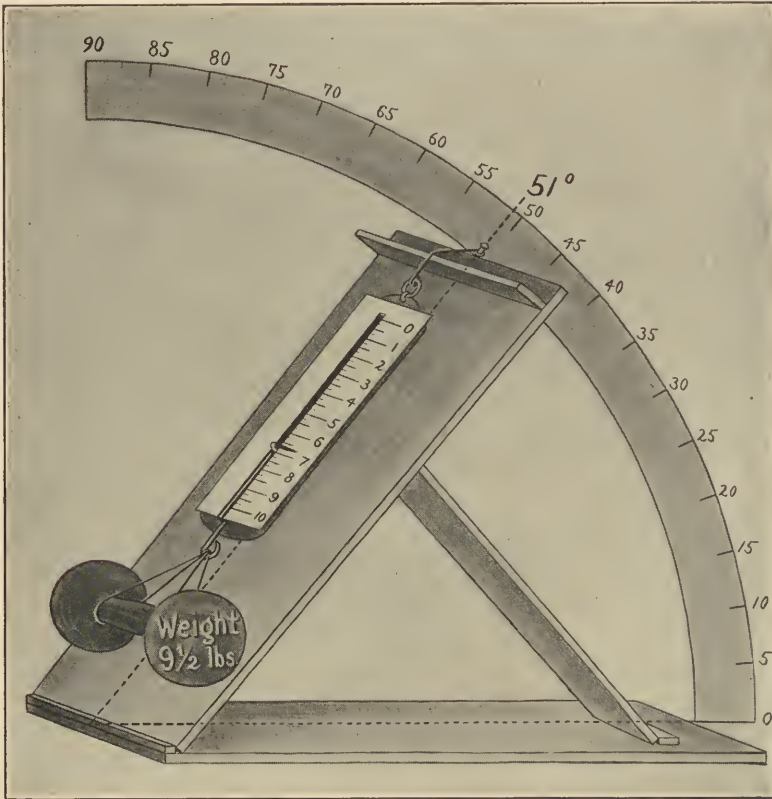


FIG. 81.—THIRTY PER CENT OF THE WEIGHT IS TAKEN UP BY A 51° SLOPE.

ment of the intestine in the quadruped. Waugh calls attention to an investigation made by an associate of his, Dr. Pirie, in a series of postmortem examinations of children under twelve years of age at the Great Ormond Street Hospital for Sick Children in London. He found, just as other anatomists have found, that there was a primitive mesentery or a portion of it in 20 per cent of all cases examined irrespective of the diseases from which they die. Therefore, 80 per cent started life with no remains of a primitive mesentery. In other words, 80 per cent had normal fixation of the ascending colon.

Nonfusion on the left side has but little bearing on our subject except

in consideration of general ptosis. Therefore, we shall devote our attention to nonfusion on the right side.

There are, of course, a great many variations in the type and extent of nonfusion. I have divided right-sided nonfusion into four arbitrary types, all of which have been seen personally by me and pictured by Mr. Trahar. First, I will mention the type nearest to normal, namely, a simple mobility of the cecum with normal fixation of the ascending colon. It is probable that this type of case in a patient with ordinary normal intra-abdominal pressure rarely gives trouble. However, it is occasionally found that in such a



FIG. 82.—NORMAL PERITONEAL ATTACHMENT OF CECUM AND ASCENDING COLON TO PARIETAL PERITONEUM. (Sobotta.)

case the cecum becomes distended, probably by gas and habitual constipation, falls over into the pelvis and develops pathological conditions, including the formation of membranes. The second degree of nonfusion is probably the one which creates most pathology. In this case, the colon has rotated over as far as and attached to the front surface of the kidney, the rest of the ascending colon and cecum remaining mobile (Fig. 84). Third, the large intestine has apparently not rotated over farther than the front surface of the duodenum to which it attaches and hangs as a dead weight, all of the ascending colon and cecum having a long mesentry (Fig. 85). The kidney is exposed. In the fourth type of nonfusion which we have described, the

ascending colon has not fused to the parietal peritoneum, and the kidney and duodenum are entirely exposed just as seen in the quadruped (Fig. 86). Floating kidney is rarely seen either in type three or four, lending much evidence to Longyear's theory that the kidney is 'dragged out of its position by an attached colon.

From these four stages or types there are an infinite number of gradations, even to the extremes of nonmigration of the cecum from the left side, and, in one personal case, there was extension of the duodenum down around the end of the cecum, just as it is found in the dog. It is unnecessary to relate all these variations in the development of the general conception.

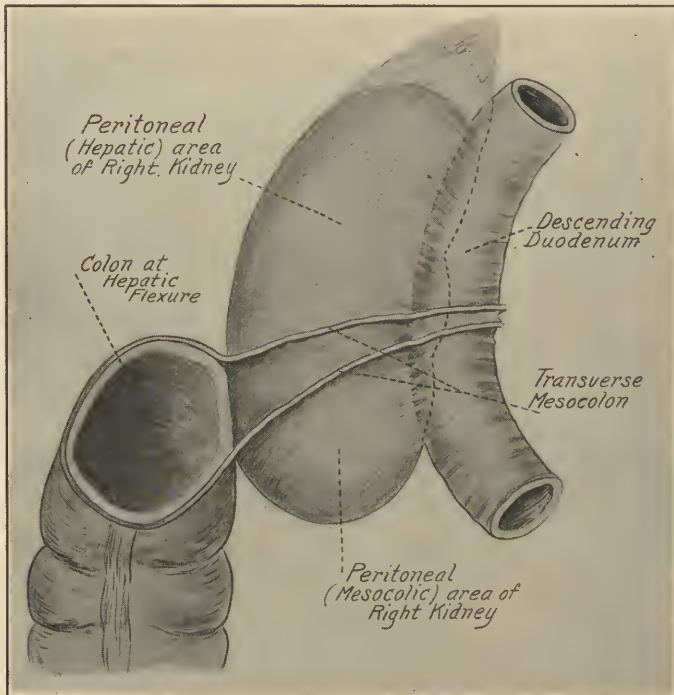


FIG. 83.—PICTURE ILLUSTRATING THE NORMAL VISCERAL AND PERITONEAL RELATIONS OF THE VENTRAL SURFACE OF RIGHT KIDNEY. (Huntington.)

Note that colon has rotated to the external side of the kidney.

Significance of Bands and Membranes.—There is probably no more bewildering subject connected with the ptosis question than this. In reading the literature on this subject, one is reminded of Saxe's poem of satire on theological disputes in which he describes six men of Indostan

"Who went to see the elephant
(Though all of them were blind)."

The first examined the elephant's side and decided he was like a wall; the second examined his tusk and thought the elephant was like a spear; the third examined his trunk and thought he was like a snake; the fourth



FIG. 84.—UNFUSED CECUM AND ASCENDING COLON. (Cecum mobile, second degree nonfusion.)

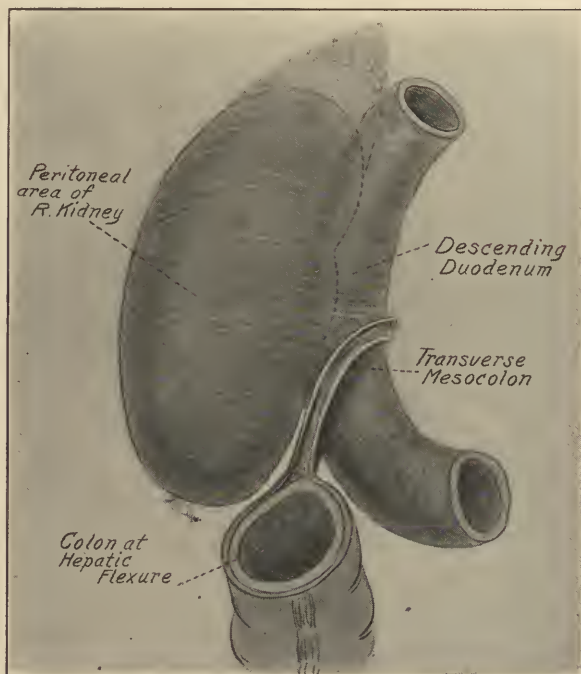


FIG. 85.—THIRD DEGREE OF NONFUSION. (Colon attached to front surface of duodenum.)

examined his leg and thought he was like a tree; the fifth, who examined his ear, was sure he was like a fan, and the sixth who examined his tail thought the elephant was like a rope.

“And so these men of Indostan
Disputed loud and long,
Each in his own opinion
Exceeding stiff and strong.
Though each was partly in the right,
And all were in the wrong.”



FIG. 86.—COMPLETE NONFUSION. (Fourth degree.)

Certain observers, basing their conclusions on postmortem examinations held on the cadavers of newborn babes, have noted the frequent occurrence of membranes and peritoneal folds at the beginning and ending of the fused peritoneal areas and believe that all noninflammatory membranes and bands found in the abdomen are congenital. Others are equally positive that they are all acquired. The everyday practical surgeon, seeing the results of acute inflammatory conditions, believes that they are all inflammatory.

Just as the parts observed and described by the six blind men of Indostan were essential to the construction of a perfect elephant, so the three kinds

of membranes and bands described in surgical literature are essential to a perfect picture of the pathology observed in the surgical abdomen.

There are certain unusual membranes occurring around and below the ileocecal junction, around the beginning of the jejunum and at the beginning of the second portion of the duodenum, which are congenital and represent anomalous fetal developments. It is significant that these congenital membranes develop only at the beginning or ending of a fused area which indicates that they are probably peritoneal remnants in the process of a normal or possibly excessive prenatal fixation. Such membranes, as a rule, perform no function, do no harm and have no special significance in connection with this subject.

- Then there are bands and membranes which have resulted from inflammatory processes particularly around the ileocecal and appendical region, the pelvic colon and generative organs and in the neighborhood of the gall-bladder, which are produced in response to an infectious process, having its origin in these organs. These bands and membranes are purely inflammatory in origin and represent a residue of reparative or protective material. Such bands or membranes have no definite direction, have ceased to function, and have no bearing on this subject except in so far as they produce mechanical obstruction or pain by incidental suspension of a prolapsing organ.

These two kinds of membranes must be sharply differentiated from those conservative membranes which have been alluded to as acquired membranes. Such membranes have been noted by J. W. Long, by Lane, and by other authors many years ago, but it was left for Jackson and Hall of Kansas City to give a perfect pathological description of such membranes. I was fortunate enough to be present when Jackson presented his original report at the meeting of the Western Surgical Association in 1908 at Minneapolis. Jackson's report follows.

"Pathological Description.—The following description of this condition is presented from the report of Dr. Frank Hall, Pathologist to the Kansas City General Hospital, from a specimen found in a postmortem subject:

"The specimen of ascending colon which you have presented to me as a type of the pericolicitis you have been interested in exhibits the following gross and microscopic features: The specimen presents the caput coil with attached appendix, the ascending colon, and a short segment of the transverse colon.

"From a point just at the hepatic flexure to three inches above the caput there spreads from the parietal margin over the external lateral margin to the internal longitudinal muscle band a thin vascular veil in which long, straight, unbranching blood-vessels course, most of which are parallel with each other and take a slightly spiral direction over the colon from the outer upper peritoneal attachment to the inner lower portion of the gut ending just above the caput. The appendix is not implicated in any way.

"Coursing with the blood-vessels are numbers of shining narrow bands

of connective tissue which gradually broaden as they go and end in a slight fan-shaped attachment at various points on the anterior and inner surface of the colon. At these points of attachment the gut is held in rigid plication.

“The entire specimen conveys to the eye the idea that an edematous fluid lies beneath this delicate membrane and reminds one of nothing so much as an edematous arachnoid, so often encountered on removing the dura mater from the brain of a dead alcoholic. The colon seems placed in a diaphanous bag slightly too short to contain it without wrinkling. At the beginning of the hepatic flexure the drawn membrane particularly angulates the contained colon. Here and there are spots and tags of fat beneath the cobweb. On handling, the specimen of colon slips about in its bag without entire freedom as a fetus without its amniotic sac. A portion of the parietal peritoneum has been removed with the colon and shows that the membrane and blood-vessels arise in, and are continuous with, the structures of the parietal peritoneum, as it sweeps over the colon. The entire structure seems to be peritoneum, loosed from its close connection to the abdominal wall and colonic surface by some serous exudate after which the particular vascularization and connective-tissue banding has occurred as a chronic reaction to irritative influence.

“Microscopic sections prepared from blocks of tissue cut entirely through to the lumen of the colon present, first, a very loose external covering, a normal musculature, a broad submucosa, and a normal glandular coat. Our chief interest lies in the serous coat, which is seen to have its fibers split asunder as if by a serous infiltrate, thus lifting the endothelial layer of the membrane, which is clearly demonstrated to exist as a covering over all. The blood-vessels present in cross section and are unusually large and thin-walled. Wherever a blood-vessel courses there also is a condensation of the white fibers into bands parallel to the vessel. The general aspect of the region under discussion is that of a mass of more or less isolated fascicles of white fibrous tissue with here and there a blood-vessel filled with blood, broad clefts lined with endothelium, and a few fat and connective-tissue cells sprinkled here and there.

“No fibrin, polymorphonuclear leukocytes, or other evidence of inflammation is present. The connective tissue next to the layer of longitudinal muscular coat is condensed and seems to penetrate in increased amount between the muscle bundles. Aside from this questionable matter, the gut and its walls are normal. The endothelial covering in places on the surface is perfectly preserved and demonstrates beyond a doubt that we have here no new or false membrane but simply a rarefied and otherwise altered natural structure. The enlargement of the endothelial-lined clefts, so abundantly observed, suggests a chronic lymphstasis as an associate condition, which is possibly a key to the formation of the amount of fluid in the tissue spaces of the peritoneum.’

“In addition to this description we would add some observations of the condition as observed in quite a number of living subjects seen in the course of surgical operations. The transparent, vascularized veil-appearance of the

membrane strikes one's attention very forcibly, with the parallel bright red vessels running with the long axis of the ascending colon. In some instances it appears as though the membrane comes on to the colon from the lateral parietal wall just above the cecum and courses directly upward to disappear beneath the liver on the superior layer of the transverse mesocolon. In other instances it seems attached like an adhesion to the under surface of the liver, well anterior to the normal peritoneal reflection. Again, in other cases, it appears as though it had begun above and descended on the colon to its termination, usually just above the cecum. We have also seen it pass across and upward to the transverse colon, which, in one instance, was apparently drawn down by the membrane, practically paralleling the ascending colon to the level of the cecum. In this case the gastric symptoms were marked as a result of the mechanical gastroptosis thus produced. In one instance this membrane was so dense as to lose entirely its apparent vascularity and transparency, and it looked like a solid sheet of organized fibrous tissue, beneath which the ascending colon was so lost that it could not be seen at all until the membrane was divided and brushed aside when an apparently normal, though contracted, colon became evident.

"In no instance does this membrane resemble our ordinary conception of an adhesion. It is never adherent to the abdominal wall nor to any contiguous loops of small intestine. Instead, it resembles more closely than anything we can describe a thin pterygium. In recent cases the membrane is quite free and produces but limited restriction to the underlying colon. In more advanced and characteristic cases it seems to bind the colon close to the posterior abdominal wall and produces such marked angulations and convolutions of the colon as practically to produce a stricture of its lumen; in fact, in one case seen in autopsy when a stream of water was caused to flow into the cecum through the ileocecal valve, the cecum distended almost to bursting, and yet none of the fluid would pass through the ascending colon and past the hepatic flexure until it was milked through with the fingers. It is also noteworthy that in the large majority of cases the cecum was not involved in the membrane at all; nor was the appendix invested, except when it occupied an ascending position at the outside of the colon, and then it was covered by the membrane as it was reflected on to the colon from the lateral parietal wall. The appendix in almost every case, however, was rather small and sclerotic. We have seen the membrane in one case in which there had been, years before, an appendicular abscess, which was drained. In this case the cecum was likewise markedly involved in the membrane. The angulation of the colon is generally most marked at the hepatic flexure. There is always a very loose space where the membrane can be easily picked up at the outer angle, where it passed from the colon to the outer parietal wall."

Dr. C. H. Mayo, who was also present, was so impressed with the membrane of Jackson's description, that he immediately christened it "Jackson's Membrane."

After having such a perfect description of this membrane, our next question is why and how does it develop? Formerly I thought, with Pilcher and others, that the immediate irritant which caused the development of such structures was bacterial in character. Lane has always contended that such membranes and bands represented crystallized lines of force laid down in resistance to the weight of prolapsing organs. With a much larger experience and a closer observation, I have become thoroughly convinced that Lane is right. Furthermore, I am sure that these membranes never develop in the neighborhood of the ascending colon except in the absence of normal prenatal peritoneal fixation.

I have made the observation in many of my cases that the membrane usually develops on the intestine at a point corresponding, when the patient is standing, to the narrow outlet in the abdomen described elsewhere as the *psoas outlet*. So constant has been this coincident that I have begun to believe that the pressure of the prolapsed distended cecum with its stagnant contents between the psoas muscle on the one and the front abdominal wall on the other, may be at least an accessory factor in the formation of the membrane. These theories in reference to a possible, immediate cause of the development of the membrane do not in the least weaken the contention of Lane that they are laid down for the purpose of holding up a prolapsed organ in just the same way that the changes he describes as occurring in bony structures are laid down to meet the emergency.

I have been much interested in the observation of the early stages of these membranes. My observations have been the same as those of Waugh and a number of others who have noted that these patients begin to show symptoms between eighteen and twenty-two years of age. The first symptom that attracts the attention of the patient, and later the doctor, is pain. The patient is usually operated upon for appendicitis, acute or chronic. When the abdomen is opened the appendix is found normal. An acute, red, edematous condition exists over the cecum and extends back of the parietal peritoneum. This growth is somewhat like a mass of red moss over the surface of the intestine. It has in all cases been found at the point on the intestine referred to above. A few years later a definite membrane or definite band forms and the acute red condition usually disappears.

M. L. Harris has given a good description of the process of formation of this membrane in the following words:

"In the early stages of the condition the wall of the ascending colon presents the appearance of being thickened or edematous and, on close inspection, the visceral peritoneum seems to be raised from the bowel wall by reason of the appearance of a subendothelial, hyaline-looking substance or exudate. The endothelial layer of the peritoneum, which is slightly movable on the bowel wall, gradually becomes separated from the bowel as a distinct layer beneath it, covering the bowel wall. There forms another layer of endothelial cells. A raised, thin, transparent membrane remains attached to the bowel at the longitudinal bands, at which point small blood-vessels may

be seen entering and spreading over the thin membrane. Later this membrane is almost certain to acquire attachments to the anterolateral parietal wall. In older cases the membrane becomes thicker, particularly along the line of the blood-vessels, which also become larger and more numerous. In still later stages, the membranous formation becomes intimately attached to the ascending colon. It extends from pouch to pouch of the colon, and, on contracting, as all such new formations do, draws the pouches together and puckers them up so as practically to obliterate them from the external



FIG. 87.—PATHOLOGY WHICH SOMETIMES ACCOMPANIES MOBILE CECUM.

This includes pericolic membrane; adherent and kinked appendix acting as a ligament; shortened mesentery of ileum producing kink as described by Lane, and also acting as a ligament.

surface of the bowel. In this stage the membrane can be removed only with difficulty and leaves the bowel raw and bleeding."

I think there can be no doubt that this membrane has been developed for the purpose of holding up an intestine which has not been normally fixed. At times this membrane develops and remains to do valuable service (Fig. 87). At other times, it stretches and forms bands (part of the membrane giving way and part of it holding the narrow, definite point), which are likely to cause severe pain in addition to adding to intestinal stasis (Fig. 88).

Similar membranous developments take place in connection with the gall-bladder and duodenum and present symptoms which often lead to unnecessary, radical operations for their relief (Figs. 89, 90 and 91).

About five years ago a patient came to our clinic with right-sided ptosis and asthenia. She had no pain; the cecum was low down in the pelvis. She was put to bed on forced feeding and rest in the recumbent posture. She gained about thirty pounds in weight and, at the end of four weeks, she began to take exercises consisting largely of walking. The weight kept on increasing. She left the hospital perfectly well. Before she left town, an



FIG. 88.—DIAGRAM INDICATES HOW PERICOLIC MEMBRANE MAY BECOME CONSTRICTING BAND AFTER HEPATIC FLEXURE HAS BEEN LET DOWN IN PROCESS OF GENERAL PTOSIS.

X-ray picture was made showing the cecum in its normal position above the psoas muscle. She was in good condition for several months. Finally, for some reason, she lost most of her flesh. Coincident with the loss of flesh, she began to develop pain in her right side. She returned for examination. X-ray showed that the cecum was in normal position, not movable. Diagnosis of appendicitis was made. On opening the abdomen, the appendix was found healthy, but two or three strong bands, one of which was an inch wide, had developed between the parietal peritoneum and the cecum. The attachment of these bands corresponded exactly to the location of the pain. Appendix

was removed. Bands were not cut but were used as material in the process of shortening the mesentery in making an indirect colopexy. Patient was completely relieved of pain and made a perfect recovery.

The only conclusion we could draw from this case was that, during her recumbent posture, membranes developed, and the fat, encircling the abdomen and filling the mesenteries, continued to hold the intestine in place. During



FIG. 89.—ACQUIRED BANDS OF THE TYPE WHICH PRODUCE GALL-BLADDER AND DUODENAL SYMPTOMS BY THE PULL OF A MOBILE PENDULOUS COLON.

this period of recumbency she apparently developed the membranes and bands. They gave no trouble until she began to lose flesh.

I have had another similar case in my experience which came with symptoms of appendicitis. She was treated three years before by forced feeding and rest in recumbent posture. In her case, however, the cecum had not been drawn back above the psoas muscle, and the bands were not sufficiently developed during the period of recumbency to hold the intestine up.

The Ptotic Body Habit.—Goldthwait and Franklin H. Martin have laid particular stress on congenital body formation in which the natural shelf of the body occupied by the kidneys and colon is much shallower than normal. Heredity has apparently much to do with this condition. Goldthwait describes such a child as follows:

“Drooping shoulders, prominent scapulae, the spine inclining upward and backward from the lumbar region with very little curve, being almost straight



FIG. 90.—DUODENAL OBSTRUCTION AT TWO POINTS. (E. L. Kellogg and W. A. Kellogg.)

Adhesions extend from the gall-bladder across the termination of the first and second portions of the duodenum to the prolapsed hepatic flexure of the colon. Treatment consisted of dividing adhesions, suturing cecum and ascending colon to posterior peritoneum and restoring the hepatic flexure.

until the upper dorsal spine is reached, when it bends sharply forward. With this the abdomen is much larger in proportion than the rest of the body, the lower portion being the most prominent, while on palpation and percussion the parts are soft and tympanitic.”

This theory of the development of the enteroptotic habit or body formation is in accord with the observations of Richard R. Smith, who has made an extensive study of the enteroptotic habit in more than four hundred women and in one hundred and nine children, and also quotes from the paper of W. J. Butler, who made a study of one hundred and fifty-three children. He states that his findings agree in the main with those of Butler.



FIG. 91.—THE MAIN LINES OF STRAIN UPON THE DUODENUM. (Vaugh.)

These are shown by the puckered folds of peritoneum which are raised up when the hepatic flexure is drawn gently downwards.

The conclusions of Smith, based on these two hundred and sixty-one frail children under twelve years of age, are as follows:

“The enteroptotic habit of adult life finds its counterpart in the frail child presenting the same fundamental characteristics: Frailness, lack of fat, slenderness of muscle, lack of vigor in body development. Any actual collapse of the thorax, or diminution in the capacity of the upper abdomen, is seen only in elder children, and then only exceptionally, even in frail subjects. The prolapse of the kidneys, stomach, colon and intestines, which accompanies the enteroptotic habit of adult life, is not outspoken in childhood (under twelve years) except in rare instances, and then usually late in that period.”

These observations by Smith have been most painstaking, and it is quite probable that any multiple of cases so carefully examined will continue to bring the same conclusions. Smith's studies of this number of children, taken with his studies of more than four hundred enteroptotic women, constitute a very valuable link in the study of ptosis. But after going over all his work, we find that there is a missing link. He has examined all of these women and children and has found that certain conditions exist, and that this habitus develops after twelve years of age, but he fails to tell us why it develops at that time. It seems that Goldthwait's studies along the same line have supplied the missing link. Goldthwait thought for



FIG. 92.—TYPICAL PTOTIC FIGURE.
(Martin.) (Drawing from Richard Smith's collection.)

Picture shows flat chest, straight back and cannon ball abdomen.

some time that this characteristic condition, known as the enteroptotic habit, was due to faulty postures in early life. As his observation became more extensive he noted that his theories would not entirely account for these cases, and as his knowledge of the subject developed he reached the definite conclusion that there must be congenital defects in most cases. After making anatomical and embryological studies along the lines which have preceded in this paper, he states:

"In this development, the colon which originally has a free mesentery becomes adherent to the posterior abdominal wall in the ascending and descending portions, and to the omentum and indirectly to the stomach in the transverse portion. At the time of birth, the development should have reached this stage, but apparently in a considerable number of cases birth takes place before this development is complete. The child is born too soon from an embryological point of view, and begins life with a movable colon, and consequently with less natural support for the stomach. The obvious result of this is that, as long as the child is an infant and its activities and

habits are largely those of the quadruped, very little disturbance occurs, but when the erect posture is assumed, the disadvantages of such formation are evident. With the stomach, the erect position must result in the sagging downward of the organ; and since the duodenum is almost always fixed, the early embryological mesentery upon this portion of the alimentary tract, having ceased to exist at an earlier period than is the case with the colon, the effect which this must have upon the evacuation of the stomach contents, with the disturbances of digestion resulting therefrom, together with the effect of the position and functions of the colon, has been sufficiently well described above. With such displacement, if the stomach is affected, there must result a gradual absorption of the retroperitoneal and intra-abdominal

fat tissue, thus naturally increasing the possibility of the visceral sag, and naturally interfering with the nutrition."

That the characteristic body conformation is due to incomplete fusion in the great majority of cases, I think is unquestionably correct. As soon as the child begins to keep the erect posture most of the time, these mobile organs begin to descend, which causes it to bend the upper part of the spine to relax the thoracic fascia. As the intestines have a direct drop (Figs. 6B, 10B) instead of staying on the shelf and remaining fixed, they gradually fall off the psoas shelf, and become a direct load. The child, in addition to bending over to relax these supports, at the same time tilts the lower part of the spine and pelvis forward, making the lumbosacral junction much less acute and to a certain extent straightening the sacrum, as Martin has shown in his work. This is done in the effort to get the weight of these organs as nearly on the shelf or on a supporting point as possible, thus relieving the drag on their mesenteries. In other words, the individual is trying to carry a load, which, while inside the abdomen, is in front of the spine. He, therefore, assumes the position which an individual assumes who carries a load in his arms in front of his body. This I have denominated the "front carrying position." Lane has called attention in his anatomical studies to the fact that, in the skeleton of an individual who habitually carries loads in front of him, the last lumbar vertebra is to a certain extent dislocated backwards on the sacrum (Fig. 93). This position of the straight lower back, leaning backward, with the curved upper spine leaning forward, makes the loins much shallower than normal, so that all organs in the abdomen have a direct drop and pull on their supports instead of resting on a shelf. Furthermore, owing to the disturbance of the gastro-intestinal tract, the nutrition of the individual is disturbed, he loses flesh, the peritoneum pulls away from the wall, and the organs fall to the bottom of the abdomen; the lower abdomen becomes permanently dilated by their presence and weight; the upper abdomen contracts to fill the vacancy; the fat is absorbed, thus diminishing intra-abdominal pressure; the intestine and stomach become dilated and filled with gas, as the result of the lack of the normal intra-abdominal pressure, and the digestion is thereby further disturbed, and an atonic gastro-intestinal tract is established. Intestinal stasis ensues from which definite pathological processes result.



FIG. 93.—FOURTH AND FIFTH LUMBAR VERTEBRAE AND SACRUM OF LABORER WHO CARRIED LOADS IN FRONT OF HIM. (Lane.)

CHAPTER X

PATHOLOGY OF INTESTINAL STASIS

For scientific information along this line, we must look largely to the British, working under the stimulation and leadership of Sir William Arbuthnot Lane. It has been studied under three headings: Bacteriology, Toxicology and Organic Pathology.

In order to avoid misquotations and misrepresentations, I have obtained the permission of those who have done the principal part of this work to use much of their original records.

Bacteriology.—Working under a grant from the British Medical Association, N. Mutch¹ prepared a very exhaustive and scientific study on bacteriology of the gastro-intestinal tract. With his kind consent, I am able to produce the summary of his work which is as follows:

“In tracing the distribution of the aërobic bacteria of the alimentary tract in healthy adults, a moderately varied and luxuriant flora is met with in the mouth and stomach; the duodenum, jejunum, and most of the ileum are relatively sterile; a few bacteria are found in the lowest coils of the ileum, whilst the colon teems with innumerable organisms. There would seem to be a continual inflow of vegetable life through the mouth, a constant destruction in the stomach, and a studied encouragement of growth in the colon. The bacteria of the duodenum and jejunum probably represent the surplus which has escaped destruction in the stomach. Those of the ileum are the resultant of an ascending infection from the colon and the remnants of the inflowing stream from above.

“Apparently the ideal which our vital mechanisms strive to attain is sterility of the alimentary tract above the ileocecal valve, with very free bacterial growth below that barrier. The reason for this is not far to seek. The upper portions of the intestinal tube are laden with food products, useful alike for human and bacterial life. The presence of many organisms in these parts would result, not only in much waste, but in the production of highly poisonous modifications of our food materials, such as amines and ptomaines. On the other hand, although the colon can absorb sugar and proteolytic products as well as water and salts, normally it is given very small opportunity of exercising this function. Mere traces of absorbable carbohydrates and amido-acids pass the ileocecal valve, their loss is inconsiderable, and it is most important that toxic modifications should not be

¹ *Brit. Journ. Surg.*, 2:608.

produced. A luxuriant colonic flora is therefore provided, to ensure their rapid destruction into relatively innocuous bodies, such as phenol, ammonia, water, carbon dioxide, and hydrogen, whilst being stored up for daily evacuation.

"To put the matter briefly, the upper alimentary tract is specialized for aseptic absorption of food, and the colon for the bacterial destruction of residues. It is conceivable that disease may arise from infection of the lumen of the upper alimentary tract, with the generation of poisonous decomposition products; or from infection through the walls of the alimentary canal, with discharge of bacterial toxins into the circulation."

Mutch then takes up the decomposition in the various parts of the alimentary canal. Concerning decomposition in the stomach, he says this is dominated by the amount of carbohydrate present and concentration of the hydrochloric acid. Unless the acidity is very markedly diminished, only a limited variety of organisms can flourish. Even with marked hypo-acidity, gastric stasis is necessary for much bacterial action. Hypo-acidity and motor disability are found in most cases of gastric carcinoma. They occur also in the simpler cases of intestinal stasis, in which neither cancers nor ulcers are present. He believes decomposition in the duodenum is rare under normal conditions. In constipation, however, there is often marked stasis in the duodenum and, from such duodenums, pathogenic bacteria can be cultivated. He studied the rate of stomach evacuation in 12 cases of marked duodenal dilatation. Dilatation was detected either by laparotomy or orthodiagraphic measurement. He gives the following table:

TIME OF EMPTYING OF STOMACH IN DUODENAL DILATATION

Patient	Operative Findings— Dilatation	X-Ray Measurements of Descending Limb	Time (in hours) for Emptying Stomach
R. J.	moderate	.....	8
K. L.	extreme	.....	9
P. S.	extreme	.....	8½
A. R.	extreme	.....	8
C. M.	moderate	.....	5
A. H.	moderate	.....	4½
A. B.	moderate	4 in.	8
D. P.	moderate	4 in.	8½
K. S.	moderate	4 in.	5
M. K.	moderate	5 in.	3
J. F.	moderate	4½ in.	4
A. S.	moderate	5 in.	5

(av. 6)

"It will be seen that the stomach was empty in less than four hours in one case only, and that the average time of emptying was more than six hours. Extreme duodenal dilatation is, therefore, usually associated with

marked gastric stasis. The probable teleological explanation of the phenomenon is, that delay at the upper end of the alimentary tube is nature's remedy for a greater accumulation of food in the lower ileum than that portion of the canal can deal with at the moment.

"The importance of this means of regulating the inflow of chyme into the jejunum is illustrated by the case of M. B., age twenty-six, who suffered from constipation, with marked ileal delay of about fourteen hours' duration, gastric delay of six hours, and a gastric ulcer not producing pyloric stenosis. Gastrojejunostomy was performed, thereby overcoming gastric and duodenal stasis, but depriving the ileum of its means of protection against overfilling. When examined six months later, bismuth poured rapidly through the hole in the bottom of the stomach and collected in the lower ileum, where, by reason of its weight, it so aggravated the ileal delay that a large mass of bismuth failed to enter the cecum till after the ninety-sixth hour. On the seventh day the ileum was empty, and all the bismuth was in the colon. Even with the aid of liquid paraffin, ileal delay was more than fifty hours, although less than seventy-four hours. The actual mechanism of production of many cases of duodenal dilatation is kinking at the duodenojejunal flexure, brought about by the heavy pull, through gravity, of accumulated chyme in the lower ileum."

The following deductions were made concerning decomposition in connection with duodenal stasis:

"1. It is usually associated with ileal stasis, and is most marked when the lower ileum is distended with food.

"2. It is usually associated with gastric stasis.

"3. It gives rise to a localized tender area in the epigastrium.

"4. It may be associated with duodenal infection.

"In the present state of our knowledge it is impossible to differentiate between food poisons produced in the duodenal lumen and bacterial toxins produced in the walls of the canal."

Concerning decomposition in the ileum, Mutch makes the following opening statement:

"It is admitted by all who have given attention to the subject that in disease the lower coils of ileum frequently contain microorganisms. It is easily proved by making cultures from ileal chyme removed at operation. That a few organisms occur in these parts of the intestinal tube in health is probable, but as yet lacks direct proof. There is, however, no doubt that in constipation the ileal flora is often immeasurably richer than in health, and that bacterial decomposition of the products of proteolysis gives rise to adverse symptoms in patients suffering from intestinal stasis. Most striking proof of these statements is made possible by the variations in ileal infection found in different subjects. For the moment it will suffice to mention two facts, and then enter on the more detailed discussion.

"1. The degree of infection of the ileum with coliform bacilli varies directly as the degree of ileal stasis.

"2. Constipated patients with subnormal blood-pressures harbor *B. aminophilus* in their ileums; other constipated patients do not do so.

"The relative frequency with which various aërobic organisms can be cultivated from one platinum loopful of diluted ileal contents (dilution 1-50) is: Coliform bacilli, 86 per cent; *B. acidophilus*, 68 per cent; *Streptococcus brevis*, 57 per cent; *B. aminophilus*, 36 per cent; yeast, 28 per cent; *Streptococcus longus*, 18 per cent; *B. proteus*, 6 per cent.

"From consideration of a large number of cases it has been possible to detect the following factors which influence the coliform infection of the ileum:

"a. The degree of infection is proportional to the ileal stasis.

"b. The ileal kink acts as a protective barrier against ascending infection from the colon as shown by the fact that, in ten cases of marked ileal kink, the average measure of coliform infection was 0.75. In 10 cases without ileal kink, the measure was 1.7. In 6 cases of extreme coliform infection of the ileum, a definite ileal kink was present in 17 per cent. In 10 constipated patients with relatively slight coliform infection, a definite ileal kink was present in 90 per cent.

"This protective effect of the ileal kink is not due to concurrent alterations in ileal stasis, because the average ileal delay of 12 consecutive constipated patients with marked ileal kinks was equal to the average delay in 12 consecutive constipated patients who had no ileal kink.

"c. The coliform infection varies directly as the duodenal dilatation.

"d. The coliform infection is uninfluenced by the acidity of the stomach."

Mutch examined the colon and lower portion of the ileum removed by Sir W. Arbuthnot Lane at operation on 50 cases and made the following points:

"Although the whole abdomen of constipated patients emits a fecal odor, great differences can be observed between the offensiveness of the various portions of the intestinal canal, and the ileocecal valve forms a great dividing line. If the lumen of the ileum is opened up by a longitudinal incision, and its contents exposed as far as a point 3 to 4 mm. from the cecal aspect of the ileocecal valve, the odor emitted is extremely faint; but immediately after the valve has been cut through completely, the usual nauseating vapors of fecal matter become urgently obvious. It is quite evident that the contents of the cecum do not usually regurgitate through the ileocecal valve. This was demonstrated more completely still by bacteriological methods. Immediately after the abdominal wall had been opened at operation, a ligature was tied around the ileocecal junction. Swabs were subsequently taken from the cecum and lowest portion of the ileum. From the former, most luxuriant cultures were obtained; from the latter, comparatively slight growth. These observations dispose conclusively of the contention which Adami has

from time to time put forward, that bacterial activity reaches a maximum in the lower ileum. The majority of the bacteria in the feces may indeed be dead; but the number of living bacteria in 1 c.c. of cecal contents is so immeasurably greater than the number in 1 c.c. of ileal contents taken 1 cm. higher up the alimentary tract, as to convince one of the relative sterility of the small intestine. On several occasions a portion of the ileum four or five feet in length was removed, and cultures were made from its contents at various points, with similar results in all cases. For example, in the case of S. K., age forty, with lifelong constipation, on whom a colectomy was done in March, 1914, the results were as follows:

Site	Character of Growth	Number of Colonies
Cecum.....	very free growth of strepto-cocci and B. coli after 24 hrs.	immeasurable
Ileum at the valve.....	moderate growth.....	50
Ileum 10 cm. above the valve..	moderate growth.....	20
Ileum 20 cm. above the valve..	slight growth.....	1
Ileum 30 cm. above the valve..	very slight growth.....	0
Ileum 40 cm. above the valve..	very slight growth.....	0
Ileum 50 cm. above the valve..	very slight growth.....	0
Ileum 60 cm. above the valve..	very slight growth.....	0
Ileum 70 cm. above the valve..	very slight growth.....	0

A few B. coli could be detected in these locations by working with larger volumes of chyme.

“From these results it is evident that not only does the ileocecal valve prevent gross regurgitation, but it also acts as a very efficient barrier against bacterial invasion of the ileum. Whether this function is dependent solely on mechanical prevention, or is aided by some bactericidal action, remains to be investigated. It would appear also that the bacteria which live in the lowest portions of the ileum in constipation very rapidly diminish in number as the distance from the cecum increases.

“Briefly, the coliform infection of the lower ileum in constipation is abnormal because:

- “1. It increases with increase in ileal delay.
- “2. Different strains of coliform bacteria are found in different ileums, B. aminophilus being present in a minority of cases.

“Some of the symptoms met with in constipation result from bacterial decomposition in the ileum because:

- “1. Tyrosin decomposition-products in the urine increase with prolongation of ileal delay, and are almost abolished by drainage of the ileum.
- “2. Tryptophan decomposition-products in the urine increase with increase in ileal stasis, whilst drainage of the ileum causes them to disappear almost completely.
- “3. Histidin, acting as precursor of β -iminazolyethylamin, produces a low blood-pressure in those patients only whose ileums contain B. aminophilus.”

Concerning decomposition of the colon, Mutch has the following to say:

"This has received much attention at various times, but is probably quite secondary in importance to ileal decomposition. As stated in the earlier part of this paper, the colon is the site of destruction of residues by an extremely luxuriant bacterial flora. The substances formed are of the simplest nature and, in the amounts absorbed, their pharmacological actions are probably so very slight as to be negligible."

Toxicology.—It will be conceded by all physicians, as well as patients, that constipation or intestinal stasis has a very important influence upon the general well-being and efficiency of the individual.

Lane,² in discussing alimentary toxemia, says:

"When these poisons or the products of their conversion exist in excess in the circulation, they produce degenerative changes in every tissue and in every organ of the body. It is probable that the textures of those organs whose business it is to convert, carry, or eliminate them suffer more than do the other tissues of the body which are merely permeated by them. In proportion as the stasis is prolonged, so, under the influence of a progressive strain greater than they are able to bear, these several organs undergo a degeneration which proceeds with increasing rapidity as the condition advances. What the organs are which convert and excrete these poisons, what share each takes in the process, and how any organ is affected in its physiology are very difficult to define accurately, especially as far as the ductless glands are concerned. We believe that the liver is the most important converter of these poisons, and that the kidneys and skin are the chief excretors of the products of conversion.

"As to the part taken by the thyroid gland, the pituitary body, and the suprarenals, we possess little precise information. Our observations in this direction are purely experimental, and if our several operations on the drainage scheme have done nothing more than demonstrate the damage done by these poisons, the remarkable power of repair which the several tissues of the body exhibit on being freed from their malign influence, and the extraordinary improvement in the functioning of the organs of the body after operation, they have been fully justified. They have, however, done more than this, since they have thrown a light on intestinal conditions which has simplified their treatment most materially, and has put them upon a definite mechanical basis, replacing what was little more than a nomenclature.

"As corroborating the wisdom of attending to the drainage scheme of our bodies I would call your careful attention to some of Dr. Carrel's experiments, since they throw a most important and instructive light on the subject. When I saw Carrel more than two years ago he showed me living tissues growing in a sterile medium on a microscopical slide. At that date they had been growing for twelve days. I asked him what would result from the defective drainage of the tissues, since the quantity of serum was

² *Proc. Roy. Soc. Med.*, March, 1913, No. 5, 6:49-177.

limited and the products of growth must be ejected into it. He said he did not know, but expected to learn shortly. After a few days he found that the vitality of the tissues became diminished, that the growth of the cells was slowed, and that it ceased very soon after. Death of the tissue took place obviously because of the imperfect drainage, just as our bodies and tissues become depreciated and finally die from chronic intestinal stasis. To meet this when growth commenced to flag, he opened up the specimens of growing tissue and washed away the toxic products, and by so doing he gave the material another period of growth extending over about fourteen days. This he was able to repeat many times before death finally took place. A line indicating the extent of growth was for a time level, then descended gradually, and finally very rapidly, illustrating exactly what takes place in chronic intestinal stasis in the human subject. By attending more carefully to the drainage of the toxic products of his specimens he was able to carry the growth along a horizontal line with regular undulations. Again, by feeding them with the juice of fetal thyroid or spleen, he increased the growth of these tissues in an extraordinary manner, the increase during twenty-four hours varying between three and forty times the bulk of the original material. In this way he replaced the gradually descending line, representing the tissue growth ending in death, by one which is rapidly ascending, and shows no indication whatever of termination in death of the tissue. In other words, by attending carefully to the drainage and by giving suitable foods he gave that tissue a perpetual life and a rate of growth enormously in excess of the normal. He proved in an indisputable manner that decay is due to an inability of the tissues to eliminate waste products. Carrel's observations are of the greatest service at the present moment, since they afford us the same confidence in our method of treatment that X-rays did in the case of operation for simple fracture when the opposition to that form of treatment was intense, and to a great extent unscrupulous in its method. I am relating this to show how very simple and yet how very important is the problem involved in the consideration of chronic intestinal stasis. I have recently seen him perform the same experiment on a larger scale. He eviscerated a cat and so arranged the drainage of the intestine that it continued to perform its function normally during artificial respiration for a period of about ten hours. He hopes by preventing the death of the organs by peritonitis to prolong their life for a much longer period. The improvement in the growth of tissue which he obtains by attending very carefully to the drainage is well illustrated in the great and very rapid increase in the growth and weight of the child suffering from tubercle or rheumatoid arthritis which takes places after the large bowel has been excluded from the gastro-intestinal tract."

Ochsner³ gives the following manifestations of intestinal stasis:

"*Malnutrition*.—Patients who are suffering from chronic intestinal stasis are badly nourished, because the condition reduces the appetite and thus the

³ *Surg., Gynec. and Obst.*, 22: 44.

amount of food ingested, and because it impairs the digestion, and consequently the patient does not obtain the normal amount of benefit from the food taken.

"Skin changes.—The complexion of patients suffering from intestinal stasis loses its clearness, the skin becomes yellow with brown spots, dark areas appear beneath the eyes, and there is pigmentation of the skin in the axilla, the groins and other flexures.

"Impaired circulation.—In most instances the circulation is impaired, as is manifested by the presence of cold hands and feet, and the presence of a cyanotic condition of the skin. The patients are short of breath upon attempting severe muscular exercise or upon mounting stairs.

"Impaired muscular strength.—These patients complain of weakness and inability to perform their accustomed amount of physical work. They become exhausted easily and do not recuperate quickly upon taking rest.

"Impaired resistance.—Intercurrent diseases are borne badly by these patients, as their normal resistance seems to be greatly below par.

"Effect upon the nervous system.—These patients are greatly depressed nervously. They may develop melancholia or hysteria. It is, of course, important to determine which has been the primary condition in these cases."

Chapple⁴ in discussing intestinal stasis lays particular stress in the changes of the female's breasts as follow:

"The breasts showed changes, which in the early stages are similar to those usually described as chronic mastitis and later as cystic degeneration. The degree of these breast changes seems to bear a direct relation to the degree of auto-intoxication and affords a definite index to the extent of the latter. That these degenerated breasts are exceedingly liable to malignant change has impressed itself most forcibly on my mind, and in this study of fifty short-circuited cases, there is definite proof that this cystic degeneration slowly but surely disappears after an ileocolostomy and the breast becomes quite clear and supple again."

Mutch makes a very interesting statement concerning the cold hands and feet in connection with stasis as follows:

"In the concluding paragraphs of this paper, I wish to discuss an almost universal symptom of constipation which probably originates from decomposition in the alimentary tract. It is considered last, because proof that it is not to be classed as an infection through the wall of the canal is still lacking.

"Almost every constipated patient suffers from coldness of the extremities, affecting hands, feet, nose and ears. A slight fall of external temperature is sufficient to cause them acute discomfort in these parts. The phenomenon may be studied by means of a very thin-walled surface thermometer with a flat bulb. The patient is placed in a room at 10° C. for

⁴ *Brit. Med. Journ.*, April 22, 1911.

a short time, and readings are taken of the temperatures of the palm, dorsum, and middle finger-pad of each hand, until these readings are constant. The right hand is then immersed in cold water at 10° C. for a minute, and quickly dried without friction. A further series of temperature readings are taken over a period of half an hour, or until the normal temperature is regained. Tested in this way, the hands and fingers of healthy adults resume their original temperature in five to ten minutes; patients with intestinal stasis require much longer than thirty minutes.

"The phenomenon is very definite indeed, and is abolished by drainage of the ileum; but the explanation is still lacking. It may be that small but persistent doses of pressor amines, which are quite inadequate to affect the blood-pressure, are yet sufficient to constrict the peripheral arterioles if aided by a cold stimulus, and produce thereby prolonged coldness of the extremities. It may also be related in some way to Raynaud's disease, which, studied from the point of view of chronic intestinal infection, affords many points of interest."

Sometimes even very serious acute toxic conditions develop as a direct result of absorption of stagnant intestinal contents.

Axtell⁵ described 12 cases occurring in a period of three or four years in which patients had been treated for from three to five weeks for typhoid fever, the temperature running above 105, with delirium and other very toxic symptoms. In all of the cases, impaction of several pints of fecal matter above the last angle of the sigmoid which Lane has called the "last kink" was the cause of the illness, as was proved by the fact that the patients were relieved of their symptoms immediately or within three or four days after the removal of the fecal matter. All of the 12 cases were reported in detail, 3 of which are related below for the purpose of giving the general course and symptoms:

"Case 1. C. U., male, age thirty-one; ill two weeks. Admitted February 13, 1910. Abdomen, retracted, boggy; cecum, tender and tympanitic; rectum and sigmoid, full; sigmoid, angulated and partially invaginated into the rectum; diarrhea; temperature, 11 A.M., 104.2 degrees; delirious and restless. Enema removed at once more than an ordinary bedpan of foul and slime-covered scybala. Temperature, 10 P.M., 100.2 degrees; delirium rapidly disappeared. In twenty-four hours the temperature was normal and the nervous conditions had disappeared. In eleven days he had fully recovered.

"Case 2. T. S., male, age thirty-two; farmer; ill five weeks. Admitted July 25, 1911. Dazed and semidelirious; had to be led by wife; temperature 105 degrees; abdomen distended; cecum, tender and tympanitic; rectum and sigmoid, full; sigmoid, angulated, deviated to the right and invaginated into the rectum, and thickened at point of invagination and angulation. Enema and inflation through sigmoidoscope removed enormous quantities of foul scybala. Next day temperature normal and dazed condition largely gone.

⁵ *Proc. Am. Proctologic Soc.*, 17th Annual Meeting, 1915.

One week later he returned unaccompanied. No return of the typhoid conditions, although it was several weeks before the fecal stasis and angulation of the sigmoid were corrected.

"Case 3. Joe A., age sixty-two; ill two weeks; was arrested for insanity. Admitted July 12, 1913; temperature 103 degrees; delirious—almost maniacal; abdomen retracted, boggy; cecum enlarged; enteroptosis; rectum and colon impacted; sigmoid angulated and invaginated into rectum. Enema removed in two evacuations a fraction less than three quarts of scybala—in the last of which was a quantity of undigested white beans. Recovery was rapid from the mental aberration and fecal stasis."

Organic Pathology.—Every observing physician and surgeon has seen cases similar to those reported above. Such extreme conditions may develop without the existence of any notable organic pathology. In fact organic pathology connected with any of the forms of constipation is very infrequent and difficult to locate in the large intestine.

Keith⁶ made a very painstaking histological examination of six colons removed and sent to the Royal College of Surgeons of Great Britain by Sir Bertram Dawson, Sir W. Arbuthnot Lane, Sir Berkeley Moynihan and Professor J. W. Smith. Colons from 2 cases of mucous colitis presented such disease and disorganization of the muscle fibers and peritoneal coats that he felt that the intestine could never have been restored to normal activity. Therefore the removal operation was justifiable. In the intestine of one very profound case of intestinal stasis, he found evidence of a disturbance in the action of plasma cells but no signs of inflammatory reaction. In three other colons from cases of intestinal stasis, there was very little change except in the mucous membrane, and the writer believes that it would be possible to relieve such conditions and restore the patient to normal health without operation.

A recent pathological report on Draper's⁷ specimens of colon and ileum, removed at the State Hospital for Insane at Trenton, N. J., has been made by James Ewing. This report is particularly interesting because of the authoritative position Dr. Ewing holds as a pathologist in this country and also because of his well-known conservatism on all matters. His report is as follows:

"I have examined sixteen specimens of colon and ileum removed at operation. The great majority of the specimens show very definite gross anatomic lesions which have resulted from chronic intestinal stasis and the ensuing chronic catarrhal inflammation. In several cases the lesions are extremely marked, in many they are well marked, while in a few there are no definite changes that can be regarded as more than minimal variations from the normal.

"The most marked and constant lesion is pigmentation of the mucosa, which has rendered the inner lining brownish or at times dark chocolate in

⁶ *Brit. Journ. Surg.*, 2: 576.

⁷ *Am. Journ. Med. Sc.*, September, 1922.

color. This change is most marked in the cecum, diminishing toward the sigmoid, but often present throughout the specimen. Sections show the pigment to be lodged in large polyhedral cells, lying in the mucosa and at times in the epithelium. Pigmentation of the colon is fully recognized as a sign of chronic intestinal stasis and intoxication. It is sometimes associated with anemia and at times with severe and even fatal dystrophies of nervous and muscular systems.

"Pouching of the intestinal wall amounting almost to hernial protrusions was observed in most of the cases. These pouches were from 1 to 2 cm. in depth. The wall of the pouches was generally thinned, sometimes very much thinned, and the mucosa at the bottom was generally eroded, sometimes ulcerated. Through such erosions and ulcerations it is obvious that absorption of fluids and bacteria readily occurred. The usual contents of these pouches must have been fecal matter, and it appears that such material must have been practically incarcerated and seldom emptied. About the lower end of the cecum the pouches were especially numerous and deep, and access to them was tortuous, especially when external adhesions held the wall of the colon fixed.

"The outer surface of the colon over the pigmented and especially over the pouched district, was generally the seat of a chronic productive inflammation with the formation of very numerous small granules of vascular connective or denser fibrous tissue. This granular appearance was doubtless exaggerated by hardening in formalin.

"The loose serous coverings of the colon generally appear as thin membranes extending from the gut over the mesentery. These coverings often showed diffuse opacity from thickening, abnormal bands and striae, and occasionally definite cicatricial contractions. To what extent these changes were due to the conditions inside the gut it is difficult to say, but probably they were largely caused by the mucous membrane lesions.

"The lymph-nodes in the mesentery accompanying the specimens were not, as a rule, enlarged, and often they were small and difficult to find. Sections of the nodes showed no inflammatory reaction of definite importance. It was noted that the lymph follicles were generally invisible in the colon and were reduced to a trace in the sections. Well-formed, recognizable Peyer's patches were not found in any case. There was therefore a general atrophy of the lymphoid apparatus inside and outside of the gut. That bacteria were found by culture in the lymph-nodes of the mesentery could have been confidently predicted on the lesions of the mucosa and the lymphoid atrophy.

"In general the impression gained from the study of these specimens was that the clinicians were dealing with extensive and somewhat unusual grades of chronic intestinal stasis and catarrhal inflammation with its sequels. In a few cases the conditions were such as to be practically irremediable except by mechanical straightening of the intestinal lumen. Whether or not extirpation of the cecum is the most direct method of accomplishing this object must be a matter of surgical judgment.

"In perhaps the majority of the cases, and certainly in some, the conditions were not so advanced that emptying of the colon was impossible by lavage or frequent catharsis. Here, again, the choice of methods must be regarded as a matter of clinical judgment. As for the specimens of ileum submitted, they failed to show any lesions that would necessarily call for extirpation. The indications for this procedure must rest entirely on clinical grounds.

"The isolation of various bacteria from the mesenteric lymph-nodes does not appear to have particular significance, since bacteria pass the relatively intact intestinal wall under a great variety of pathologic conditions, many of which have no connection with the clinical state of these patients. More important is the demonstration of hernias, pouching, thinning of wall, pigmentation and ulceration of the mucosa, which together form an impressive anatomic basis for the theory of intestinal intoxication, which undoubtedly existed in severe degree in the cases exhibiting such lesions.

"Finally, I would venture to express my personal opinion that extirpation of the affected portions of the cecum and colon was justifiable and probably the only effective means of relieving the condition found in the advanced cases, while in others with slight changes the condition could have been met by less radical means. The extirpation of considerable portions of the ileum appears to me unwarranted if based solely on the anatomic condition of this organ."

I have occasionally seen a stercoral ulcer, in fact my first short-circuiting operation was done in 1906 for stercoral ulcer. The patient was extremely toxic, with marked constipation and stasis. Reverse peristalsis took place and a year later the colon had to be removed. At that time there were no ulcers present in the intestine and no gross pathological changes. But the question which Lane has stressed so much is pathology remote from the immediate seats of stasis. The reader is no doubt familiar with Lane's views as to the far-reaching consequence of intestinal stasis. Indeed Lane would lead one to believe that a great many of the most serious diseases are due directly to intestinal stasis. Concerning his views as to intestinal stasis being the cause of cancer, either directly or indirectly, I have failed to see any convincing evidence. Concerning ulcer, particularly of the duodenum, there is much more chance for argument. Those who have worked on the subject of duodenal arteriomesenteric ileus find some very suggestive evidence.

Wilkie, in the October, 1921, number of the *British Journal of Surgery*, reports 2 cases of ulcer occurring with gastromesenteric ileus, in which the duodenum was obstructed below by the superior mesenteric artery and above by the scar of an ulcer. Practically all agree that a mobile cecum is a frequent cause of duodenal arteriomesenteric ileus. Therefore, indirectly the mobile cecum would be the real cause of an ulcer, as Waugh has suggested, and has substantiated his suggestion by the report of four of gastric and six of duodenal ulcers cured by fixation of the cecum and ascending colon.

A number of the cases of duodenal arteriomesenteric ileus which have been reported by other surgeons have been accompanied by duodenal ulcer. Likewise, a number of cases of perforated duodenal ulcer have been found to have an accompaniment of arteriomesenteric ileus which have been reported by other surgeons as having been accompanied by duodenal ulcer.

While these reports of Wilkie and Waugh are very suggestive, it may be said there is nothing in Wilkie's histories to show that the ulcer did not precede the ileus.

Indeed, it is possible and even probable, that the loss of fat consequent upon an obstructive duodenal ulcer might cause reduction of intra-abdominal pressure and lengthening of the mesenteries sufficient to produce a duodenal arteriomesenteric ileus. Thus, the ulcer may be the cause of the ileus rather than the ileus the cause of the ulcer. Furthermore, is it not possible that the two might be coincidental occasionally?

Waugh's ⁸ report on relation of ulcer and mobile colon is very interesting. He attributes much importance to the morbid consequences of a mobile ascending colon and, under the head of "Abdominal Diseases," writes the following:

"A list of surgical diseases of the abdominal cavity drawn up without reference to the contents of this quadrant would include little save those of the appendix and rectum, and abdominal operations would so shrink in number as to lose their entirely preponderating position amongst present-day surgical procedures.

"Surgical endeavor has been concentrated, for the last twenty years, upon the task of a successful modification of method and technic in the treatment of such end-stages of disease as gastric and duodenal ulcers, gall-stones, and prolapsed right kidneys. While meeting with an uncertain measure of success—an uncertainty that is revealed by the life history of gastrojejunostomy from its inception to the present time; by the rival claims of gastrojejunostomy against gastrectomy; by a preference for the use of the cautery instead of the knife, for excision of a gastric ulcer, with nascent hopefulness about the tissue; and by the hesitation that is experienced in attempting to decide between the merits of cholecystectomy and cholecystostomy—it has been subconsciously realized that the problem of the origin of these diseases has not been solved, that the treatment evolved has not been based upon that knowledge, and that an erratic distribution of failures and successes is an inevitable consequence of empiricism.

"Nor have scientific investigations upon animals, in spite of patient and brilliant research, been able to throw much light upon the human problem, or to add much, from the knowledge thus gained, to the successful treatment of these diseases in human beings. By means of cytotoxins and attenuated bacteria, some of the diseases, in some measure, have been reproduced in animals, but so lacking in faithful mimicry of the human lesion that it is impossible to escape from the conclusion that some factor has been wanting

⁸ *Brit. Journ. Surg.*, January, 1920.

from the experiments that has robbed them of complete success. This factor is possibly a mechanical one—one that would be difficult to improvise in the course of an experiment, but which is ready to hand in the human being, who is perpetually exposed also to the influences of bacteria and toxins. This factor, I venture to think, is resident in an abnormal mobility of the ascending colon; and by an appreciation of its significance some solution may be found of the general surgical problems which form the background for the study of these diseases. Some of these problems may be indicated briefly in the form of questions:

“1. Why are all these diseases grouped together in one small area of the abdominal cavity?

“2. Why are they almost unknown in childhood?

“3. Why does their onset occur so frequently about the age of twenty years and onwards?

“4. Why are gastric ulcers clustered around the pyloric region of the stomach, and why is it that duodenal ulcers are almost always in the first and second parts of the duodenum?

“5. What are the prodromal stages of gall-stones, gastric ulcers, and duodenal ulcers?

“6. Why is the right kidney so frequently mobile in these diseases, and why is it the mobile one in 80 per cent of all cases of movable kidney? (Thomson Walker.)

“7. Why does the right kidney so frequently prolapse again after very firm surgical anchorage?

“**Mechanical Factor.**—It is certain that, apart from some specific infective diseases, ulcers in most parts of the body—more especially the conjunctiva, tongue, septum of nose, legs, sacral and gluteal regions—are formed directly under the influence of a recognizable mechanical factor, and that healing can be brought about only when the mechanical irritant has been removed. The mechanical factor that leads to focal ulceration of the stomach and duodenum, to the stagnation of bile, and to mobility of the right kidney, may conceivably be provided by a mobile ascending colon.

“**GASTRIC ULCERS.** Case 16. E. S., female, age thirty-one. One attack of hematemesis, June, 1915. Gastric pains five years. Appendicectomy four years previously, dyspepsia many years. Laparotomy, August, 4, 1915; indurated ulcer size of a quarter on anterior surface of stomach just to left of pylorus; complete primitive mesentery to ascending colon; colon fixed in usual way. Made a very rapid recovery, and reported quite well on May 30, 1918.

“Case 17. D. H., female, age thirty-six. Had been treated for four years in different hospitals for gastric ulcer, during which period two grave attacks of hematemesis had occurred; appendix removed seven years previously. Admitted, blanched from third attack of hematemesis, to Hampstead General Hospital on June 25, 1917. Very ill, and treated by conservative measures until August 9, 1917, when laparotomy was performed: Large

ulcer, size of a half dollar, on anterior surface and upper border of stomach to left of pylorus; complete mesentery to ascending colon, which was fixed in usual way. Up to date of operation had not been able to take anything more solid than Benger's food, and then with severe pain; ate fish on tenth day, and meat on fourteenth day, after operation. Anemia rapidly improved, and she returned to work four months after operation. Reported herself quite well in June, 1919.

"Case 18. J. D., female, age twenty-seven. Dyspepsia several years, gastric pain one year, severe melena on several occasions, and hematemesis on July 17, 1917, when she was admitted to Hampstead General Hospital. Laparotomy, August 25, 1917: Two ulcers present about size of a quarter and a dime respectively, on anterior wall of stomach and duodenum on either side of pylorus; true mesentery to lower half of ascending colon and pseudomesentery to upper half; colon fixed in usual way after apparently healthy appendix had been removed. Uninterrupted recovery, and reported on June 15, 1919, to say that she was in perfect health.

"Case 19. A. H., female, age twenty-nine. Dyspepsia for some years, constant gastric pain for six months, even with fluid diet. Laparotomy, October 16, 1918: Ulcer size of a dime on anterior wall of stomach close to lower border, about one and a half inches from pylorus; complete mesentery to ascending colon. Fixed colon in usual way, and small, apparently healthy, appendix removed. Uninterrupted recovery. Wrote August 6, 1919, to say that she had never been better in her life.

"DUODENAL ULCERS. Case 20. D. B., female, age twenty-seven. Dyspepsia one year, hunger pains three months, with two attacks of melena lasting about twelve days. Laparotomy, August 11, 1917: Complete true mesentery to whole of ascending colon. Ulcer size of a dime in second part of duodenum, just above hepatic flexure. Colon fixed in usual way, and healthy appendix removed. Writes August 10, 1919, to say that she has been in perfect health ever since operation.

"Case 21. A. H., male, age forty-seven. Dyspepsia for some years. Hunger pains six months. One attack of melena lasting for ten days in January, 1918. Laparotomy, March 20, 1918: Large ulcer in second part of duodenum, just above hepatic flexure; complete true mesentery to ascending colon. Colon fixed in usual way, and small healthy appendix removed. Reports September, 1919, that he is quite sound.

"Case 22. E. H., female, age thirty-eight. Many years' treatment for dyspepsia and chronic pain. Three attacks of melena during past five years. Appendix removed seven years ago. Laparotomy, May 11, 1918: Large ulcer in second part of duodenum; true mesentery to lower two thirds of ascending colon, and pseudomesentery to upper one third. Colon fixed in usual way. September, 1919, still has slight dyspepsia, but no pain, and considers herself to be better than she has been for many years.

"Case 23. E. S., female, age twenty-six. Dyspepsia and hunger pains on and off for five years. Appendix removed two years ago, no relief. Laparotomy, March 2, 1919: Small ulcer in second part of duodenum; complete

mesentery to ascending colon; gut fixed in usual way; August, 1919, so far very well.

"Case 24. A. A., female, age thirty-one. Many years' dyspepsia and pain, one attack of melena lasting seven days. Appendix removed three years ago; no better. Laparotomy, May 2, 1919: Ulcer size of a dime in first part of duodenum; complete mesentery to ascending colon. Colon fixed in usual way. September, 1919, has put on 10 lbs. since operation and is very well.

"Case 25. F. L. C., female, age twenty-nine. Dyspepsia and chronic pain for last nine months, during which period had two attacks of melena and one of hematemesis. Laparotomy, May 22, 1919: Ulcer in first part of duodenum just to right of pylorus; complete mesentery to ascending colon; gut fixed in usual way, and small healthy-looking appendix removed. November, 1919: Has been quite free from pain, and only has slight flatulence occasionally."

It is not stated whether these cases have been well all of the intervening time between the date of the operation and the date of the report. The intermittent character of ulcer symptoms makes the word "cure" a very uncertain and elusive term.

In the days of heated contests as to the relative merits of medical treatment and gastro-enterostomy for duodenal ulcer, Dr. W. J. Mayo was accustomed jocularly to remark that he always refused to operate upon any patient for ulcer who had not had at least seven medical cures. Most ulcers have been cured one or more times each year for a number of years before the surgeon sees them.

In discussing the connection between ptosis or stasis and ulcer, it is interesting to note that the statistics of Lane, Rovsing, and in fact practically all authorities working in the field of gastro-intestinal stasis, have found that approximately 80 per cent of ptosis and stasis cases coming to the surgeon are females, while the statistics of the Mayo Clinic and other prominent surgeons indicate that 75 per cent of gastroduodenal ulcers are found in men. My personal experience is that ulcer is most frequently found in previously healthy young men who are quite clear of constipation. However, this is a question which requires a great deal more study before final settlement.

It will be necessary for surgeons carefully to examine for the mobility of the cecum in all cases of operation for ulcer. As to Lane's claim that appendicitis is a part of intestinal stasis, we have to say that so far as chronic appendicitis is concerned, we entirely agree with Lane but, as to acute appendicitis with the formation of pus, we have quite another story. For here, again, the majority of cases are found in young, and previously healthy males, and furthermore my own experience, which agrees with the experience of some others, is that acute appendicitis is not frequently found in the ptotic individual with a very mobile cecum. Indeed, it has been proportionately less frequent in ptotic individuals with stasis than in so-called normal individuals

whose intestinal canal has been normally fixed. Therefore the relationship between appendicitis and stasis is not yet settled and, like the relationship of ulcer, requires a great deal of observation and farther study.

As to the production of gall-stones, there is far more to be said as to stasis being the direct cause. We have very little evidence to show that the intestinal canal has any influence on the production of tuberculosis other than the relation of the general weakened condition produced by stasis.

One of the principal claims of Lane for colectomy is in the cure of chronic multiple arthritis, known as Still's Disease, which Mutch believes is a secondary intestinal infection in which less usual organisms than the bacillus coli are found in the ileum, producing toxins which do harm rather than food decomposition products. Mutch⁹ believes that Still's Disease is due to these bacterial toxins. He quotes the following instance of Still's disease which occurred in the practice of Lane:

"D. W. (under the care of Sir. W. Arbuthnot Lane), a boy, age five, had been ill for two years, during the greater part of which he had been treated at one of London's leading hospitals for children. The outstanding clinical features of his disease were marked wasting (his weight was 2 st. 10 lbs.) and chronic enlargements of his joints. He was quite unable to walk, and his pain and weakness were so great that the assistance of two nurses was required whenever he was moved. The principal joints involved were the ankles, knees, wrists, elbows, and those between cervical vertebrae; but the changes were not confined to these regions. Swelling was considerable, and chiefly in the periarticular structures. Most of his superficial lymphatic glands were enlarged. His spleen also was increased in size, and palpable. Blood counts revealed considerable anemia of a secondary type. His Wassermann reaction was faintly positive and his von Pirquet reaction negative. He had intermittent attacks of pyrexia. Blood cultures made during these attacks gave a pure growth of *Staphylococcus citreus*, and his opsonic index for this organism was 1.8, both of which points are of surpassing interest when viewed in the light of the following history of his alimentary canal. Seven hours were occupied in the evacuation of his stomach, although a little bismuth passed through the pylorus almost as soon as taken. The duodenum was elongated, and bismuth passed through it very slowly. There was great delay in the ileum, and very little bismuth entered the cecum during the first eight hours. The passage through the colon was sluggish, and after twenty-four hours most of the bismuth was still in the first half of the large intestine. Dr. Still kindly saw the patient, and agreed that the disease was identical with that peculiar form of chronic multiple arthritis which he personally had described. He expressed the opinion that under the usual recognized medicinal treatment the patient had prospects of life for a few months only. A laparotomy was made which confirmed the X-ray examination. The duodenum was seen to be distended. There was a marked ileal kink, and the pelvic colon was greatly elongated. Ileocolostomy

⁹ *Brit. Journ. Surg.*, 2: 608.

was performed, and cultures made from the ileum. From these a growth of *Staphylococcus citreus* was obtained. It is clear that the stagnant ileum had become infected with this organism, which had then gained entry to the tissues through the intestinal mucosa and produced chronic arthritic changes in all parts of the body. This circumstance is made even more striking by the fact that cultivations have been made by Dr. Eyre or myself from the ileal contents secured at operations on 55 other patients not the victims of Still's disease, and that in no case has a single colony of *Staphylococcus citreus* appeared. After the operation rapid improvement took place, and in a few weeks' time he was able to play about, entirely free from pain. Nine months later, stiffness reappeared in the vertebral joints, and although there had been no recurrence of pyrexial attacks, he was still thin and anemic. Cultures were made from the feces and blood, without detecting the presence of *Staphylococcus citreus*. X-ray examination demonstrated regurgitation into the blinded colon, bismuth being found in all parts of the large intestine as far as the cecum, forty-eight hours after a bismuth meal. Colectomy was therefore performed. A year later he was going to school and playing games. He was the backbone of the junior-school cricket eleven.

"It is now two and a half years since he was seen by Dr. Still, and his recovery appears to be complete. He has gained 12 lbs. in weight during the last fifteen months, and his pallor and weakness have gone. The enlargement of his lymphatic glands and spleen have entirely subsided. His joint movements are almost perfect."

Another disease which Lane has featured very much as being one of the remote results of stasis is Raynaud's disease. Mutch quotes the following case from Lane's clinic:

"G. W. (under the care of Sir W. Arbuthnot Lane), a man age twenty-four, had suffered from Raynaud's disease for nine years.

History.—His symptoms commenced with attacks of coldness of the fingers and toes during the winter. In later years the attacks involved his hands and feet, and even spread as far as his elbows and knees. At first they came on during the winter months only, but lately they had frequently occurred in the summer also. During the attacks, the affected parts usually became white and 'dead,' being devoid of all sensations; sometimes, however, they were blue and cyanosed. As early as eight years ago, trophic ulcers appeared on the finger tips, and these recurred, with much destruction of the superficial tissues in succeeding years. For three years he had suffered also from syncopal attacks, which showed no relation to the weather or to the peripheral spasm in his limb vessels. They varied in frequency from one per month to three or four per week. At these times he lost consciousness completely, and on waking up again felt drowsy for several hours and experienced severe headache, with palpitation and throbbing in his neck. He did not usually recover in time to see his friends raising him from the ground where he had fallen. These attacks were not associated with incontinence of

urine or biting of the tongue. No history was obtainable of dyspnea on walking, of precordial pain, or of edema of the legs.

"His alimentary history was as follows: In his youth, defecation had been regular, and unaided by artificial means: but during the last few years he had suffered from alternating attacks of constipation and diarrhea. In his diarrheal condition his motions were watery, but normal in color and free from blood and mucus. Sometimes his bowels were open sixteen times in twenty-four hours, but there was no coincident abdominal pain. Before the onset of diarrhea his appetite became poor, but he rarely suffered from indigestion pains of any kind, and was never troubled by heartburn, nausea, retching, vomiting, or gastric flatulence. No other symptoms could be elicited. During the last two years he had received almost continuous



FIG. 94.—A CASE OF RAYNAUD'S DISEASE. (Mutch.)
Note the symmetrical and severe scarring of the finger tips.

medicinal treatment, including faradism and light baths, but no improvement had taken place. The last few months he had spent in an infirmary, being so crippled that he could no longer earn his living.

"*Examination.*—He was seen to be a thin man of normal height, with cold, bluish extremities. He walked very slowly and with a limp, because of the stiffness of the joints and tissues of his feet. His hands were clawed, and so stiff that he had great difficulty in dressing himself. The fingers were covered with scars, which reached their maximum distribution near the tips of the fourth and fifth digits (Fig. 94). The terminal segments of the little fingers were mere cicatrices supported by bone. The severity of the scarring diminished towards the radial margin and towards the hand and forearm, but four small scars marking the site of trophic ulcers were present about the wrist and lower part of the left forearm. Similar symmetrical changes were found in his feet. Here scarring was most marked on the big

toes. On the inner aspect of the left leg, a little above the ankle, was a scar of a large and recently healed ulcer. It is interesting to note that the bones also showed changes. There was great rarefaction of the phalanges of the hand, which corresponds accurately in its distribution with that of the changes in the superficial structures. Evidently the arteries to the bones partook in the spasm at the same time as did those supplying the soft tissues of the fingers. There were no scars on the ears or nose. The physical signs in the alimentary system were hardness, tenderness and immobility of the terminal coil of the ileum, slight tenderness over the third part of the duodenum, with hardness of the pylorus and slight tenderness over the iliac colon. His appendix was not felt. No sign of sepsis could be found in his mouth, nose, or pharynx.

"X-ray-and-bismuth examination furnished the following results:

"*Stomach*.—The greater curvature dropped to the pelvic brim in the vertical position. About eight hours were required for its evacuation.

"*Duodenum*.—The first and second parts filled readily, but bismuth entered the jejunum very slowly. The duodenum was elongated, the vertical part being four and three-quarter inches long. It was also dilated, and showed strong writhing movements, with regurgitation of its contents. The tenderness of the third part was confirmed.

"*Ileum*.—There was only slight delay in the ileum, but the last coil was fixed at a point about one inch from its termination, where it became kinked in the vertical position after the entry of the bismuth into the cecum. The tenderness of this coil was confirmed during the screen examination.

"*Appendix*.—Bismuth entered its lumen. It was freely movable, not tender, and not controlling the ileum.

"*Colon*.—The cecum was in the right iliac fossa. The transverse colon was elongated, and dipped into the pelvis even in the horizontal position. There was some elongation of the pelvic colon, and distention of the rectum. The iliac colon was tender, and bound down. Bismuth entered the cecum in two and a half hours, and reached the rectum in twenty-six hours; but much remained in the transverse, descending, and pelvic colons until the forty-fifth hour, although the bowels were opened at the twenty-fourth hour.

"In this way were demonstrated dropping of the stomach, elongation of the duodenum, transverse and pelvic colon, and kinking of the ileum. There was marked stasis in the stomach, duodenum and colon, and a little in the ileum.

"A routine examination was made of his lungs, nervous system, joints, thyroid gland, heart and blood-vessels; but no further abnormality was detected beyond a faint hemic bruit.

"His blood yielded the following data:

Brachial blood-pressure, 115 mm. Hg.

Red-count, 5,040,000 cells per c.mm.

Hemoglobin, 78 per cent.

Color index, 0.8.

White-counts (at 10 A.M.), 13,400 (at 6 P.M.), 12,200; mean, 12,800.

Differential-count: Polymorphonuclears 43 per cent.

Lymphocytes	50	"	"
Eosinophils	2	"	"
Hyalins	4	"	"
Mast-cells	1	"	"

"He thus displayed anemia of a secondary type, and a positive lymphocytosis. His urine gave distinct evidence of a coliform infection of the ileum. A twenty-four hours' specimen was amber-colored, and its specific gravity 1017. Sugar, albumen, urobilin, acetone, diacetic and indolacetic acids were absent, but a little indican and considerable hydroxyphenylacetic acid were present.

"Adrenalin 1-1000 did not produce any dilatation of the pupils when instilled into the conjunctival sac.

"*Operation.*—Laparotomy was performed by Sir W. Arbuthnot Lane, and the X-ray findings accurately confirmed. The colon was removed, and the ileum jointed to the pelvic colon. Contents were withdrawn from the duodenum for bacteriological examination. At the commencement of the operation, the last coil of ileum was isolated from the colon by ligature, and its contents were examined about an hour later.

"*Examination of Intestinal Contents—Duodenal Contents.*—The fluid was of a pale straw-color, faintly opalescent, and strongly alkaline to litmus. Plate cultures from five loopfuls on nutrient agar gave two colonies of *Streptococcus brevis*. Into 500 c.c. of peptone broth 1 c.c. of the fluid was inoculated and incubated for one week. The formation of pressor bases, including ergotoxin, was disproved by rendering the broth alkaline with sodium carbonate and extracting it with ether. The ether was washed, and allowed to evaporate at room temperature. The residue taken up in saline was injected into a 'spinal' cat without producing any effect on its blood-pressure. The conclusions to be drawn are that no pathogenic organisms other than a few short chained streptococci were present in the duodenum.

"*Ileal Contents.*—The chyme was brown, gelatinous, odorless, and markedly alkaline to litmus. Plate cultivations yielded 200 colonies of coliform organisms, 23 colonies of a short-chained Gram-positive streptococcus which produced a mauve pigment and liquefied gelatin, and 30 pale colorless colonies of Gram-positive streptobacilli. The last-mentioned organism was in the form of long narrow rods and grew freely in blood agar and blood-serum in small pin-point colonies. It formed acid from galactose, traces of acid from maltose, levulose and dextrin, but none from dextrose, lactose, dulcitol and glycerin. It did not alter litmus milk, and grew very slowly on gelatin without liquefaction. A few minute colonies also appeared on agar. It resembled the predominant organism seen on direct examination of the ileal chyme. It will be seen that it grows well on blood media only, and rarely forms acid in sugar media. Spores were not observed in any of the cultures, and there was no gas formation.

"I do not claim that these organisms are the cause of Raynaud's disease, but their presence in the ileum is at least suggestive. Many other cases are needed before definite conclusions can be drawn.

"Ileal contents were also inoculated into 500 c.c. of peptone broth, and organic bases extracted as before. The extract caused a distinct rise in blood-pressure in a 'spinal' cat, showing the formation of pressor bases. It did not cause any reversal of the adrenalin effect, from which observation it must be concluded that ergotoxin was absent.

"The formation of the pressor body by the ileal flora is of interest in connection with the suggestion that the coldness of the hands of constipated patients is due to a reaction of the peripheral arterioles to the combined stimulus of slight cold and small doses of vasoconstrictors. The patient's hands became warm immediately after the operation, and have remained warm persistently for seven weeks. Although before drainage of the ileum, ordinary cold water induced syncopal attacks in his hands, he could now, seven weeks after operation, wash in a mixture of ice and water in a moderately cold room with impunity. When his finger tips were tested, the reaction was similar to that of simple constipation, but the tissues in the locality had been extensively destroyed and were largely cicatricial, so that the comparison was not a fair one.

"One of the most striking features of his recovery was the speed with which the stiffness left his hands and feet. His hands became quite supple, and the clawing disappeared within twenty-four hours; seven weeks later he was walking about freely without a limp.

"Although to a critical mind the suggestion that this case of Raynaud's disease was due to an infection of the alimentary tract may not seem to have been completely proved, yet the following facts are significant:

- "1. Two unusual organisms were present in the ileum in great numbers.
- "2. There was marked chronic intestinal stasis.
- "3. The ileal flora produced pressor bases from peptone.
- "4. The disease was cured by colectomy."

CHAPTER XI

ABDOMINAL PTOSIS

Ptosis is a prolapse downward of one or more of the abdominal viscera to such an extent that their normal relations to adjacent and surrounding structures are materially changed when the subject is in the erect posture. According to origin, the question may be divided into congenital and acquired ptosis. (Acquired ptosis is discussed in Chapter XIII.)

Congenital ptosis is that form of visceral prolapse which is due to deficient, prenatal, peritoneal fusion between the primitive peritoneal covering of the ascending or descending colon and mesocolon, or of both ascending and descending colon, and the primitive posterior parietal peritoneum of the abdomen. (*All children born with this defect may be considered potential ptotics. Conversely, general ptosis is impossible without this defect.*)

Congenital ptosis may be divided according to its extent into general ptosis, right-sided ptosis, right-sided and midline ptosis, and left-sided ptosis (rarely, if ever, found).

General Ptosis.—General ptosis is that form of abdominal ptosis in which, as a result of defective fixation of the ascending and descending colon, the viscera of the upper abdomen, including both kidneys, have descended from their normal position. The sequential phenomena of general ptosis are as follows: The child is born with defective prenatal peritoneal fixation of the ascending and descending colon. From the time of birth to puberty, the child may be normal but is usually considered a frail child who has frequent gastro-intestinal disturbances and who is said to have a weak stomach. Beginning with adolescent physical development, at which time the child, more or less, ceases to be a quadruped, the unfixed colon, having a direct drop from its incomplete attachment instead of resting on a shelf of 51 degrees, normal attachment, begins to slide over the psoas muscle and off the psoas shelf through the *psoas outlet*.¹ The flanks or kidney fossae gradually become shallower. The kidneys, first the right and later the left, begin to slide downwards. The tug of the ascending colon and cecum, pulling on the duodenum and bottom of the stomach, gradually displaces the middle or pyloric portion, later the duodenum, liver and even the pancreas. Poor

¹ In Chapter II, it is seen that a transverse section of a plaster cast in a given subject is 44 square inches. Four inches lower down, at the crossing point of the psoas muscles and promontory of the sacrum, a cross-section of the plaster cast of the abdominal cavity of the same subject is 14 square inches. This narrow point produced by the promontory of the sacrum and crossing of the psoas muscles, we have, for convenience, termed the *psoas outlet* of the abdomen.

digestion gradually supervenes with consequent loss of flesh. This loss of flesh diminishes intra-abdominal pressure in a corresponding amount and thereby accordingly reduces the visceral support normally furnished by intra-abdominal pressure. This reduction of intra-abdominal pressure permits of an increased amount of gas and fluids within the gastro-intestinal tract which gradually dilates the viscera. This dilatation with consequent stretching of muscle fiber gradually tires out the muscles, thins the walls and reduces peristalsis which, in turn, further reduces the efficiency of the digestive apparatus. Nutrition by this condition is brought still lower. The fat is still further reduced. There is a corresponding reduction in intra-abdominal pressure with further dilatation of the viscera. And so the vicious circle goes on as long as the patient maintains the erect posture. In the meantime the organs begin to occupy the lower abdomen to an increasing extent. Because of the weight and also because of a reduction in vitality and a gradual stretching of the structures of the abdominal wall, the capacity of the lower abdomen is increased. At this time, the chest of the patient, who in 80 per cent of subjects is a young female, with soft young bones, gradually collapses, partly because of the vacant space left by the absence of the upper abdominal organs and also because of traction on the diaphragm and thoracic fascia. The descent of the ribs from their points of attachment becomes more marked and their angles with the spine sharper. By this means, the lower chest and upper abdomen are narrowed. These bones gradually become fixed in this position which reduces the space in the upper abdomen and thereby makes the habitat of the migrating organs permanent in the lower abdomen. During this process, nature has not been idle. As the organs have gradually slid off the *psoas shelf*, through the *psoas outlet*, she has tried to rescue them by tilting the lower part of the pelvis and spine forward in an effort to get under the sliding load. The upper spine has been tilted backward in the effort to hold the load by means of the thoracic fascia. As a result the normal concavity of the spine disappears and the spine becomes relatively straight with the lower end tilted relatively forward and the upper end backward. The effort to adjust the neck and keep the head erect and in normal poise creates a bend at the upper dorsal spine which makes a permanent hump in the back. This constitutes what has been termed the "ptosis habit." This drag on the visceral nerves and sympathetic plexuses without doubt materially affects the nervous stability of the patient. Hence, the reason for classifying such patients under the head of "neurasthenia." Secondary bands, membranes and adhesions are relatively infrequent in this type of cases, owing to the fact that all organs go down together, including the parietal peritoneum, which leaves no fixed point from which the development of the membrane begins. Severe constipation and intestinal stasis are not so marked as in the local forms of ptosis.

With this conception of general ptosis in view, the rationale of the empirical "rest cure and forced feeding treatment" of neurasthenics devised by Weir Mitchell becomes apparent as does also the reason for the orthopedic and postural measures of Goldthwait and Franklin Martin.

Treatment.—In the field of general ptosis Goldthwait's work stands out preëminently. Therefore, I am taking the liberty to quote Goldthwait's idea of the principles which should be used in the treatment of this condition as published by Joel E. Goldthwait and Lloyd T. Brown: ²

"The question of treatment with a problem having so many phases as this involves so much that all that can be attempted at this time is to suggest the principles which must represent the basis of the treatment, leaving the carrying out of the principles or their adaptation to the many features presented by such cases to the individual observer.

"Naturally the first thing to be desired is to restore the organs as nearly as possible to their usual position and at the same time to correct or relieve any imperfections in their function which may have resulted from the malposition.

"Since it must be evident that the posture commonly assumed by the individual is a definite factor in the relative position of his viscera, naturally any undesirable position should be overcome, and, since the embryological changes which, when delayed, make it possible that some of these disturbances may go on after birth, and, according to the anatomists, they do go on to a more nearly normal condition, it should be our aim to see that, during the growing period of the child, especially the early period, the common postures are not harmful. It should also be our aim to see that not only are the postures not harmful, but that all possible contributing factors to visceral sag are eliminated, the costume especially being studied and harmful features corrected. It should be remembered that in the common droop of the body not only are the back muscles strained, but, with the crowding of the organs together, the pressure of one against the other must result in the stretching of the ligaments, and necessarily will lead to the absorption of the surrounding and supporting fat tissue. If, with this, external pressure is also added, such as would result from the use of tight or imperfectly fitted corsets, or tight waist-bands, the absorption of this fat tissue will be more marked, and consequently one of the important supporting elements of the viscera is lost. The writers feel that this represents one of the most harmful effects of corsets as they are commonly used. It is not the corset itself that is especially harmful any more than many other parts of the costume that convention demands, but the abuse or the ignorant use of it. With the absorption of the normal fat tissue, the inference which such garments must have upon the abdominal muscles is, of course, also to be fully recognized.

"The Cervical Fascia Important in Visceral Support.—The posture that is most favorable for normal health is with the trunk erect, as it would be if one were to stand as tall as possible without rising on the toes. In this position, as has been fully described in the article previously mentioned, all of the active supporting elements act most easily, and there is the least tendency to ptosis of the viscera. In this position not only is the framework favorable for such support, and all the abdominal muscles tight so that the support from below is the best that is possible, but also in this position the

² *Boston Med. and Surg. Journ.*, No. 21, 162: 695.

cervical fascia, which in its continuation through the pericardium is the supporting ligament of the diaphragm, is made tight. Since the liver and the stomach with the colon are largely suspended from the diaphragm, the importance of this cervical fascia in connection with the visceral positions is easily appreciated. Not only is this so, but when it is known that much of the weight of these viscera is thus suspended from the neck, the neck pain which is commonly mentioned in these cases is understood and the characteristic attitude assumed by patients having these congenital displacements is easily explained. The attitude is the same in general character whether the patient be old or young, and once the type is understood the position of the viscera is evident almost at a glance. The writers feel that the full significance of the cervical fascia as the supporting ligament of the diaphragm, and consequently as part of the support of the abdominal viscera, has not been generally appreciated and consequently is given especial emphasis at this time. In the X-ray study of this subject it has been clearly shown that, by merely changing the position from the droop to the erect position, the position of the bottom of the stomach can be raised from one to two inches.

"In attempting to correct the position of these organs it is apparent from what has been said that the organs can be drawn up from the top and also pushed up from below. This latter feature is evident from the position of the stomach shown in such a case, the protrusion of the stomach forward as well as downward making it possible to place supports over and under the lower abdomen that can really push the stomach up towards its normal position. At times both of these elements of support have to be used, and by apparatus to hold the body erect so that the cervical fascia is tight, together with pads below, the ptosis can to a considerable extent be overcome. In planning these it must, however, be remembered that, if the attempt is to be made to force or draw the stomach upward, space must be allowed for its bulk when it is in its new position. If the clothing is tight it is evident that with the new position the bulk of the stomach may for a time lie directly over the pancreas and duodenum, with a resulting increase in all the symptoms. This has been seen so many times by the writers and is so anatomically reasonable that its occurrence should always be allowed for in managing the supports.

"With this, of course, the nutrition should be planned so that the abdominal fat can be replaced as fully as possible, and at times it is well to have the patient kept in bed while this is going on. If such is the case, or if for any reason it is necessary to keep the patient in bed, the possibility of the backward sag of the stomach upon the pancreas and duodenum should be remembered, and the continuous position upon the back be avoided.

"Since it is possible to raise the stomach by tightening the cervical fascia, it is well, at the time when the stomachic digestion is going on most actively, to have the patient lie upon the back with a pillow under the region of the eleventh or twelfth dorsal vertebra and with no pillow under the head. This position of hyperextension should be kept for about half an hour, after which the position upon the side, or, better still, the knee-chest position,

taken for a few minutes, will overcome any harmful backward sag against the pancreas and duodenum and at the same time tend to unload the stomach into the duodenum.

"If for any reason it seems evident that the condition is being made worse because of the scanty secretion of any of the glands or organs, these elements should be supplied in so far as is possible. The stomach elements and the pancreatic element are probably the most important of these.

"If the organs cannot be brought back into place by the ordinary simple means, and the general condition is such that radical steps seem indicated, operative measures for such purpose are indicated. Such occasion will probably not often arise, but in one case of the writers', because of a constantly recurring gastro-mesenteric ileus whenever the stomach was, by posture and support, brought up to the region of the duodenum, such an operation was performed with relief by Dr. F. C. Kidner at the request of the writers.

"If for any reason the colon cannot be properly drained by cathartics or lavage, and this seems to be the primary source of the diseased condition, operations for the thorough drainage of this organ are to be considered. This will also not often be required, but in two cases of the writers', in which control was impossible with other means, a colotomy was performed at their request by Dr. Hugh Cabot, with entire relief of the symptoms in one case and with partial relief in the other.

"Such, in general, are the principles which seem to the writers of chief importance in the treatment of these conditions. The body should be restored as nearly to its normal anatomical condition as is possible, because it is in this condition that the most perfect function can take place. Braces should be used, operations should be performed, exercises should be given, or any other measures may be considered if the result of such measures is the more perfect function of the part. Naturally the simplest course that will accomplish the result should be the one chosen, and the radical measures should be adopted only where the simpler ones have failed. The general hygiene should naturally be as perfect as possible, and with this the diet should be planned so that with the least effort the nutrition can be brought up to as near the normal as the individual is capable of.

"When all of these things have been considered and braces have been used or operations have been performed, the treatment should not stop until the individual is in as nearly the normal condition as it is possible to obtain, and since so large a part of the support of the viscera consists of the muscular elements, these structures should be brought up to their proper tone. Special exercises should be given, at first cautiously, in order not to cause joint strain or increase the visceral displacement, but with a gradual progression in the activity until the strength is such that the proper postures can be maintained and this part of the visceral support rendered as perfect as possible. With the exercises, massage or the special forms of bathing have, of course, their very definite place, as has any other measure that tends to increase the muscular or ligamentous tone.

"With all this the patient should not be allowed to leave us until the

structures are in good tone and a practical explanation has been given of the anatomical and mechanical features of the visceral function, and with a proper understanding of the way in which the body is to be used in order to insure the least waste of body energy and consequently render the individual capable not only of health, but also of the greatest possible efficiency."

Details of postural treatment by Franklin H. Martin have also done much in the formulation of our modern nonsurgical treatment of these conditions. In order that Dr. Martin's³ principles may be thoroughly understood, I quote him as follows:

"I. General visceral ptosis is indicated, among other things, by a ptotic figure that is characteristic, by a peculiar attitude of the individual when standing, and by marked muscular insufficiency.

"II. General visceral prolapse leads to intestinal stasis, digestive disturbances and neurasthenia, and, in the author's opinion, is one of the important etiological factors of the Lane kinks of the terminal end of the ileum, Jackson's membranes, kinks of the pylorus, the cystic duct of the gall-bladder, the duodenol-jejunal junction, the appendix at the termination of its meso-appendix, the transverse colon and other portions of the large bowel, and to a distinct contraction of the parietes of the upper abdomen.

"III. These various intestinal bends, when long continued and when subject to considerable mechanical irritation or to intercurrent inflammation, become fixed by adhesions, and, as they are in a disadvantageous position, their bends and fixations must be corrected before the ptotic individual can be successfully treated for his ptoses.

"IV. In uncomplicated general ptoses or ptoses in which the complications have been corrected by surgery, the treatment herein described gives prompt, and, if conscientiously followed, permanent relief, except in the congenital type. In the congenital type, too, relief is obtained if the subject persists in the treatment.

"V. The treatment consists in substituting active muscular exercise for passive exercise and rest, the active exercise being made acceptable and advantageous by directing that it be taken while the patient is in the Trendelenburg position; and by reënfencing the muscular parietes, at the beginning of the treatment, by properly constructed supports to be worn by the patient while in the perpendicular position.

"VI. Systematic persistence in this treatment strengthens the defective muscles and, by the aid of gravity, replaces the prolapsed viscera. The temporary supports retain the viscera at their proper level until the fat deposited as a result of better nutrition, and the reconstructed muscular parietes, make a permanent anatomical support.

"VII. The author's results convince him that this treatment in relieving ptosis will prevent relapse of the complications of ptosis, if they are first relieved by appropriate surgery, and thus make unnecessary the radical

³ *Surg., Gynec. and Obst.*, 15: 150.

surgery of Lane, which involves 'short-circuiting' or extirpating the colon, or the operation of Coffey, which has for its object expansion of the upper abdomen.

"Temporary Supports.—The most effectual and satisfactory preliminary abdominal bandage is the Achilles Rose adhesive moleskin plaster, placed upon the abdomen while the patient is in Trendelenburg position, after the viscera have been restored (Fig. 95). If this is found to afford relief, and severe symptoms, which reveal adhesions or prolapsed viscera, do not follow its application in a short time, a well-fitting canvas abdominal sup-



FIG. 95.—APPLICATION OF THE ACHILLES ROSE ADHESIVE PLASTER. (Martin.)
Bandage applied with patient in Trendelenburg position.

port or corset can be substituted for wear during the day. These permanent supports in the form of bandages and corsets are shown in Figs. 96, 97, 98, 99. The essential thing in any abdominal support for the treatment of these cases is to have it uplift rather than compress the contents of the abdomen.

"Exercise and Correction of Postural Habits.—The exercises are of two varieties, those which are practiced in connection with postural treatment in the Trendelenburg position and those practiced while wearing the abdominal support in the upright position.

"The individual with the marked type of ptoses is required to arise from his bed each morning and assume a position on his back upon his extempor-

ized Trendelenburg table, without a bandage (Fig. 100). While in this position, simple active muscular exercises are indulged in.

"In order to systematize these exercises and classify them for the purpose of giving instruction to my patients or to nurses who have charge of the cases, I have outlined a few simple maneuvers.

"The first movement, which I frequently prescribe to my convalescent patients who have the ptotic habit and have been subjected to surgery because of intercurrent difficulties or complications of ptosis, consists in the slow flexion of the leg on the thigh and the thigh on the abdomen, without unflexing or extending the leg and without lifting the foot from the bed.



96

FIG. 96.—STYLE OF ABDOMINAL BANDAGE OF A VERY DESIRABLE TYPE FOR BOTH MEN AND WOMEN (Martin.)



97

FIG. 97.—A CORSET ABDOMINAL SUPPORT. (Martin.)

This shows effect of application on an exaggerated feminine type with ptoses.

Fig. 101 depicts this simple act with either limb. Fig. 102 is the same maneuver with both limbs.

"As this is one of the simplest exercises and reserved for convalescent patients it is carried out upon a cot at the side of the patient's bed, the end of which is elevated by placing a chair under it to secure the Trendelenburg position.

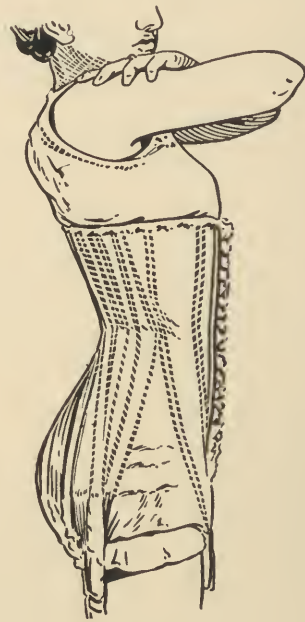
"The regular routine exercises hereinafter described are best carried out on an ordinary ironing board employed as a convenient substitute for the Trendelenburg table.

"Movement two consists in slow, extreme expansion of the chest by deep inspiration and slow expiration. In my opinion, this is the most impor-

tant exercise that can be prescribed for a ptotic patient, and for that reason it is insisted upon as the alternate movement in connection with all the others. To secure the best effect in ptoses, this exercise should be practiced in the Trendelenburg position and should be performed with (a) pressing both hands upon the lower abdomen toward the diaphragm; (b) elevating the shoulders with arms extended slowly at right angles to the sides (Fig. 103); and (c) elevating the arms above the head perpendicular to the body. This movement brings into play the diaphragm, the abdominal muscles, the back muscles, the depressors and levators of the ribs, the shoulder muscles, the strong pectoral, the trapezius and even the strong cervical group of muscles.



98



99

FIG. 98.—SAME STYLE OF SUPPORT APPLIED TO A MALE PATIENT. (Martin.)

FIG. 99.—FORM OF CORSET FOR PTOTIC FEMALES WHICH IS VERY SATISFACTORY. (Martin.)

“The third movement is the elevation of the lower extremities at right angles to the trunk, with preliminary knee flexion (Fig. 104); then slow flexion at the knees, followed by extreme flexion of the thighs on the abdomen; and, finally, slow extension to beginning position. This movement may be carried out (a) with one limb at a time, or (b) with both limbs simultaneously.

“These two movements, when properly accomplished, exercise some muscles that are seldom brought into extreme action by the ordinary use of the extremities; especially is this true of the deep psoas muscles, the deep posterior sacral and back muscles, and most markedly the recti and pyramidalis muscles of the abdomen.

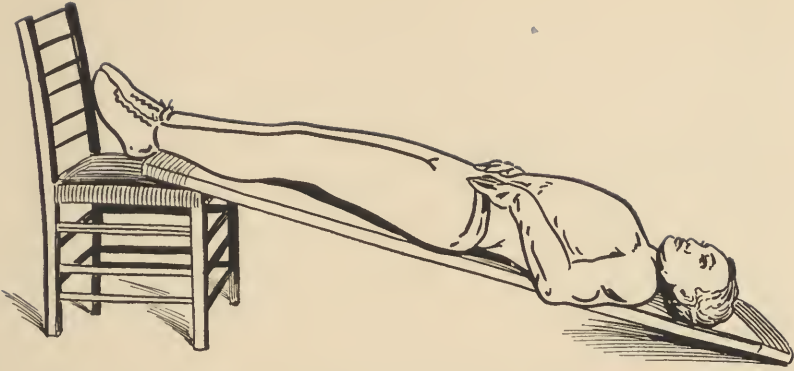


FIG. 100.—POSITION ADVISED FOR EXERCISES DESCRIBED FOR PTOTIC PATIENTS. (Martin.)



FIG. 101.—MOVEMENT ONE. (Martin.)
This consists of flexing leg upon thigh and thigh upon abdomen.



FIG. 102.—SECOND ACT OF FIRST MOVEMENT. (Martin.)



FIG. 103.—MOVEMENT TWO. (Martin.)

This consists of exaggerated expansion of the chest with arms above the head or, as in Fig. 102, with pressure of hands over the lower abdomen.

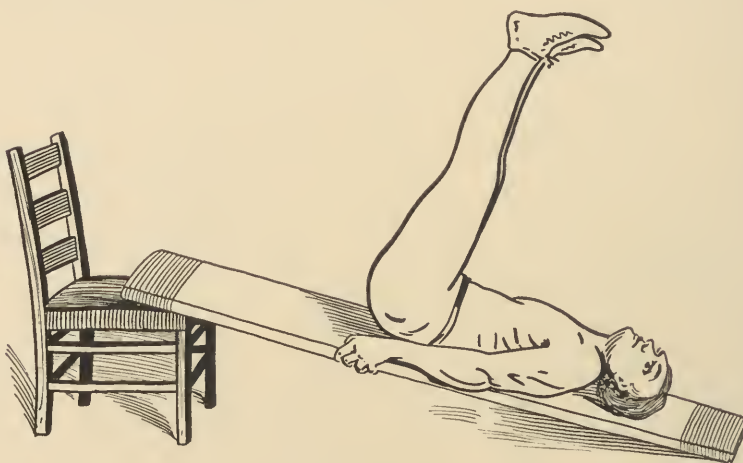


FIG. 104.—MOVEMENT THREE. (Martin.)

After extreme expansion of limbs, one at a time and then together, leg is flexed upon thigh and thigh upon abdomen, followed by return of extended horizontal position.

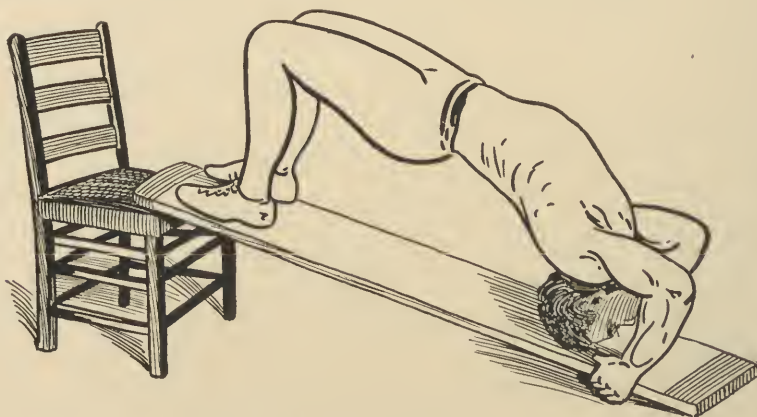


FIG. 105.—MOVEMENT FOUR. (Martin.)

"The fourth movement consists of slowly elevating the lower portion of the trunk on the soles of the feet and back of the head and shoulders (Fig. 105). This obviously brings into play the strong extensors of the back, the lumbar, dorsal and posterior cervical group, the anterior muscles of the thigh and the front and lateral muscles of the abdominal walls.

"A fifth movement employed with the stronger patients consists in raising the body to a sitting position with the hands by the side, or, if necessary at first, by grasping the edge of the board with the two hands to assist in the movement (Fig. 106).

"These movements are the important ones, and rather than add confusion by multiplying them, I modify them slightly. To exercise the adductor and abductor of the thighs, and particularly to reach the little obturator and

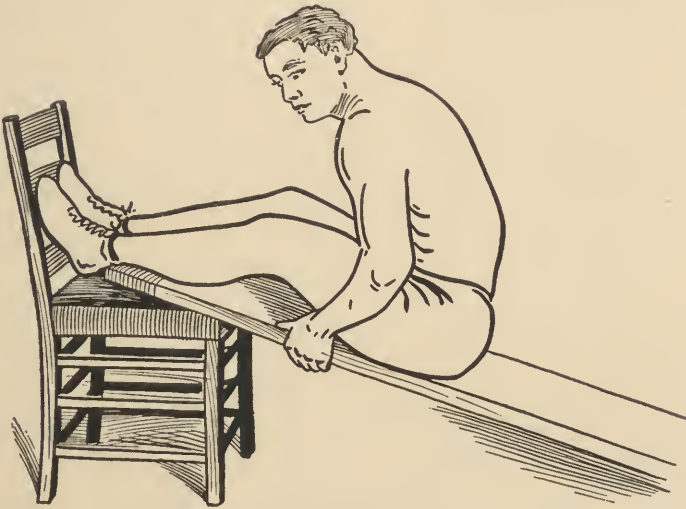


FIG. 106.—MOVEMENT FIVE. (Martin.)

pyriformis which are both outside and inside the pelvis, in a sixth movement, the patients are instructed to (a) separate the knees widely with the two feet parallel, with the soles flat on the board (Fig. 107); or (b) a more difficult exercise, with the two feet extended at right angles to the body, slowly to separate them to the extent of comfort (Fig. 108).

"Patients who are weak and unaccustomed to active exercise are assisted at the beginning by the nurse or a member of the family until such time as they can exercise by themselves.

"Frequently it is desirable to employ the influence of posture, more particularly in prolapsed or retroverted uteri, where these organs are not permanently fixed by adhesions. This I have designated as the seventh movement.

"There are three influential factors that may be utilized in these cases in the gymnastic and postural treatment; (a) replacement of the displaced uterus by the knee-chest posture; (b) ballooning the vagina and sometimes

the rectum by distending them with air; (c) aiding these two measures by contracting and relaxing the abdominal muscles and the diaphragm.

"The exercise consists of three movements in the hands-and-knees position either on a level surface, or, better, an inclined plane (Fig. 109). The

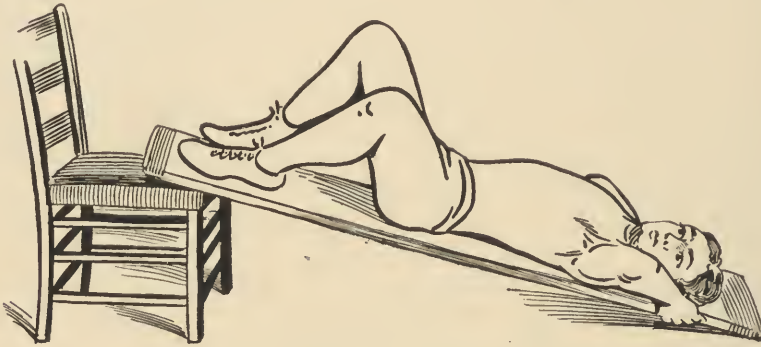


FIG. 107.—MOVEMENT SIX (a). (Martin.)

(a) movement is slow, deep inspiration and expiration of the lungs in the knees-and-hands position; (b) lowering the upper portion of the body so that the chest and knees will be in contact with the board (Fig. 110); (c)

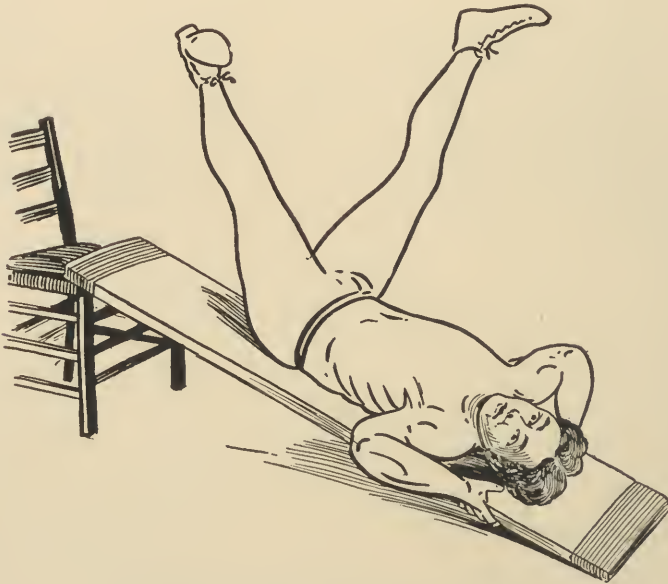


FIG. 108.—MOVEMENT SIX (b). (Martin.)

deep inspiration and expiration while in the last or true knee-chest position; finally returning to the knees-and-hands position.

"These movements may be repeated slowly from knee-hands to knee-chest and back again, with deep breathing interspersed. This maneuver is

usually prescribed as the last one of the series of exercises. The patient is then instructed to assume her bed or couch in Sims' position for rest.

"The ballooning of the vagina is facilitated and assured if there is any doubt about its being accomplished, by instructing the patient to slip a small

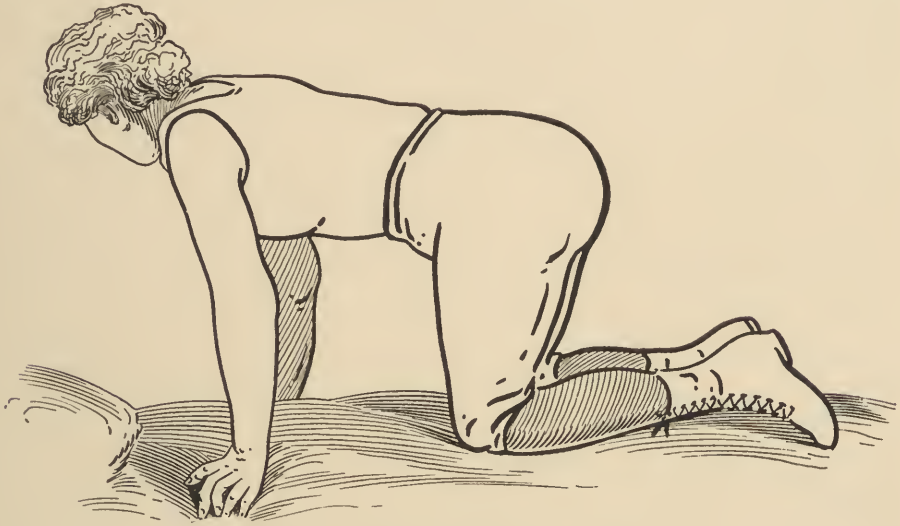


FIG. 109.—MOVEMENT SEVEN (a). (Martin.)

tube of glass or hard rubber with a vulva protecting flange into the vagina before beginning the maneuver. This insures an inrush of air into the vagina when the patient assumes the knee-chest position, thereby throwing the cervix high and into the hollow of the sacrum and favors a forward move-

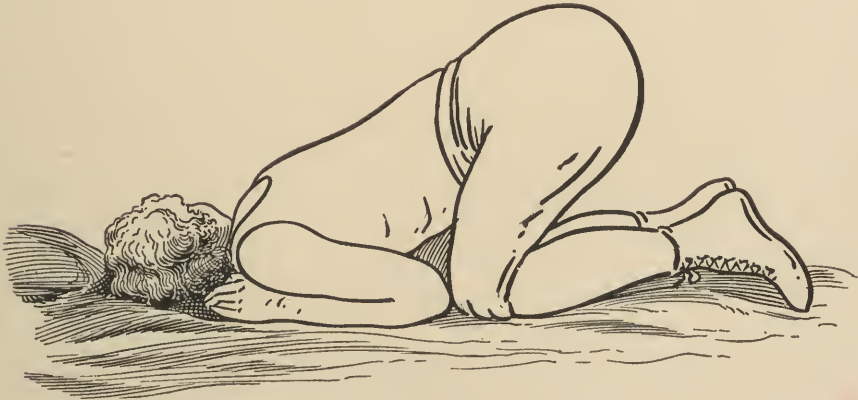


FIG. 110.—MOVEMENT SEVEN (b). (Martin.)

ment of the fundus of the uterus by gravity and by the bellowslike or aspirative action of the abdominal cavity with the contraction of its muscular walls. Where still further action is required on the fundus of an impacted uterus, means should be used to balloon the rectum as well as the vagina.

"It is advisable, if exercises of the kind recommended in this paper are to be of any value, to impress upon the patient the importance of them, and to give exact directions in regard to the length of time to be employed with the movements and the exact kind and number of each movement. In order that the patients be well started with the exercise, it should be conducted at first under the supervision of a conscientious nurse. Later the exercises should be observed once or twice a week by a nurse or other reliable attendant, who will make a definite report on the progress of the patient. This report should include the weight of the patient and measurements at extreme inspiration and expiration of the chest, waist, and abdomen, also measurements of the abdomen at the tip of the ninth rib with full chest expansion and contraction.

"At the beginning it is well to prescribe a few movements carried out slowly, ten to fifteen minutes' time being allowed morning and evening. As the patients develop muscular strength, the movements may be increased from three or four of each of the principal movements properly alternated, to six or eight or even ten of each carried out more rapidly and occupying from fifteen to twenty minutes' time for their execution.

"In ptotic cases the bath and rubdown, consisting of a sponge bath in convalescent cases, with a coarse towel friction rub, should be given in the recumbent, or better, the Trendelenburg position. Then, after the required rest, a properly supporting abdominal bandage should be applied, with the patient in the Trendelenburg position. The patient should then be allowed to assume the upright position.

"The patients should be enjoined carefully to avoid the compensatory stoop while in the standing or walking position. With the abdomen properly supported, and the viscera at their normal height, hugging the posterior parietes instead of dangling forward far from their normal attachments, the desire for the forward bend is partially eliminated and the individual finds that he can more easily maintain his normal position because the normal center of gravity is restored.

"It is but a step now, when the patient finds that he can walk with ease without the feeling of weakness and insecurity in his abdomen that compels him to adopt the ptotic attitude, to the time when he will gladly walk long distances and adopt other outdoor exercises which will develop muscles naturally and give him an appetite for nourishing food and refreshing sleep.

"Fresh Air and Feeding.—With the individual restored to such an extent that his digestive organs are functioning normally, with exercise that will send him into the open air, appetite will develop. Nourishing, fat-making food should now be prescribed for the patient and an accumulation of a normal amount of fat encouraged.

"Complications of Ptosis.—Surgeons who have been looking for them have found accompanying, if not directly depending upon, general or partial ptoses, kinks or bends in the intestines which obviously have produced pathological stasis. These occur particularly at the pylorus, the duodeno-jejunal junction, the terminal end of the ileum, the transverse colon and the

sigmoid. Frequently the condition is made permanent by adhesions due to peritoneal inflammation caused by infection or excessive mechanical irritation of misplaced or overriding viscera.

"A low-riding cecum distorts the appendix, causes a kink at the distal meso-appendix attachment and leads to chronic appendicitis. A descending liver produces flexion on the cystic duct and at periods of exacerbation causes gall-bladder symptoms which call for surgical interference, which interference reveals gall-bladder infection, and occasionally extensive adhesions about that region. An intractable kidney in which severe crises are a frequent symptom, and which cannot be relieved by abdominal supports, will be found to be one that is not easily replaceable.

"These cases all require surgery. The kinks must be relieved from their adhesions and the organs replaced. This, however, in ptotic individuals is not sufficient.

After the surgery has been accomplished, *through a sufficiently large incision to enable the operator to do his work well and to assure him that he is not overlooking something important in these individuals so prone to multiple complications, the viscera should all be carefully restored to their proper level by the aid of the steep Trendelenburg position.* Dressings should be placed in such a position on the abdomen that, by the application of a snug adhesive plaster corset, they will retain the hitherto displaced viscera in their normal position.

"The patient is then transferred to a bed with a 15° Trendelenburg incline, and kept in that position for from forty-eight to seventy-two hours, or until such time as the replaced intestines and other viscera have reformed their adhesions (if they must be reformed) in an *advantageous* rather than the former *disadvantageous* position. The patient is then treated as a chronic ptosis case, along the lines already outlined in this paper.

"In another communication I have dwelt upon the management of the adherent kinks at the terminal end of the ileum, the properly called Lane kink. At least forty such cases of my own have been treated by the above routine during convalescence. The success of the treatment has been remarkable in more than 80 per cent of the cases operated on, and the disappointments have only been partial, and in direct relation to the failure of the patient to carry out the rather irksome details of the treatment.

"I very often find in ptotic cases that mucous colitis promptly disappears, if the colon is free from adhesions and is replaceable, under the treatment I have suggested for general ptoses. The replacement of a nonadherent, prolapsed colon may be encouraged by filling it with water while the patient is in the Trendelenburg or knee-chest position.

"Another definite complication of the general ptotic individual, for which I recommend surgery, is the narrow upper abdomen which contracts and becomes permanently narrowed above the prolapsed viscera. The operation advocated has for its object the increasing of the capacity of the narrowed portion. The narrowed upper abdomen is a compensatory atrophy which is inevitable in direct proportion to the sagging and disappearing of its contents.

"The treatment I have outlined is particularly applicable to several of the processes leading to that condition. In a series of cases I have seen the upper abdomen and lower chest walls expand rapidly under the practice of the Trendelenburg position accompanied by the exercises outlined in this paper. This gravitates the prolapsed viscera to the neglected upper abdomen, and combined with forced expansion of the chest walls and exercises of the abdominal and back muscles, directly increases the capacity of that portion of the abdomen. The results of this treatment in this respect are so marked and prompt that I have been led to believe that its thorough trial will make the expanding surgery unnecessary?"

Surgery.—Abdominal operations of one kind and another for general ptosis has brought surgery for ptosis into general disrepute among both surgeons and medical men. When we take into consideration the definition of general ptosis we have given at the beginning of this chapter, it is not hard to see the reason. Fixation of one organ while others prolapse is far worse than no operation.

I wish to be particularly emphatic by reiterating that, when both kidneys are down, we have a general ptosis; that the kidneys never come down except in the presence of defective prenatal fusion of the ascending and descending colon to the parietal peritoneum. This was recognized twenty years ago when I did my third operation for ptosis—first operation for general ptosis—in a case of known locomotor ataxia.

The patient was thirty-two years of age, had had the lightning pains and diminished reflexes for more than three years. When she consulted me, she had been in bed constantly five months with occasional attacks of lightning pains down her legs and one or two typical attacks of gastric crisis. Nausea, vomiting and constipation were her principal constant symptoms, particularly marked when the patient attempted to stand on her feet. In fact, so great was the distress when standing that the patient had taken permanently to bed five months before I saw her.

On examination, it was found that the stomach was well down in the pelvis when the patient stood on her feet; kidneys fell almost into the pelvis. The upper abdomen was very narrow, the chest was contracted, and the lower abdomen was expanded to a large degree.

I recognized the importance of the case and, as I had performed only two hammock operations for midline ptosis prior to this time, I hesitated to propose surgery for her. But she was very anxious for relief, so in December, 1902, the following operation was performed: Both kidneys were anchored firmly to the quadratus lumborum. The falciform ligament of the liver was shortened and extended into a Y ligament. The omentum was sutured to the abdominal wall above the umbilicus practically all the way across. The sheaths of both recti muscles were split below the umbilicus and closed after the method of Webster. The stomach symptoms were relieved and the patient's stomach remains in good condition to-day (twenty years after operation), and her abdominal organs are functioning normally and

comfortably, although the patient still has no patellar reflexes, has very ataxic gait and still has lightning pains in her legs.

Had I at this time simply anchored one kidney, or even both, I have not the slightest doubt that these kidneys would have been pulled down again by the intestine or the patient would have had dragging abdominal pains. The operation would have been pronounced a failure for the simple reason that the underlying etiology and pathology had not been reached. By anchoring the kidneys, and supporting the colon (which is the natural drag and which usually is the agent that pulls the kidney out of position), and by firmly anchoring the liver above and contracting the lower abdomen, something of a normal state was produced. This good result was produced in face of the great handicap of the patient being a tabetic.

My twenty-first case of ptosis—second case of general ptosis—was treated surgically. Mrs. Sch., operated on May 30, 1908. Preoperative symptoms: Nausea, anorexia, constipation, abdominal pain. Confined to bed most of the time for many months. Preoperative findings: Pendulous abdomen. Distance between umbilicus and anterior spine markedly increased. Upper abdomen and lower chest narrowed. Both kidneys, stomach, liver and colon entirely below the umbilicus, and uterus retroflexed. Typical enteroptosis habit.

Operation and later course: Both kidneys anchored. Liver anchored by making a Y-shaped ligament. Omentum sutured to the abdominal wall. Upper abdomen expanded by the plastic operation. Six weeks later the uterus was supported by plicating the round and broad ligaments on the fundus and front surface of the uterus and the abdomen was contracted by making an autoplasmic bandage of the external oblique. When the patient recovered, the contour of the abdomen was very much changed. She was gradually restored to health and three and one-half years after the operation was fairly well and able to do her own housework, but stomach and colon were lower than normal. Had hypermotility (X-ray Figs. 111 and 112). Ten years later, practically well.

My twenty-second case of operation for ptosis—third case of general ptosis—was performed in September, 1908, with the following history: Mrs. B. L., age thirty, nurse, married, no children. Preoperative symptoms: Indigestion, constipation and neurasthenia to the point of invalidism. Had had a ventrosuspension performed five years before. Preoperative findings: Stomach, colon and both kidneys were prolapsed. Enteroptosis without the habit.

Operation and later course: Appendix removed. Liver was suspended by making a Y-shaped ligament. Gastrocolic omentum sutured to the abdominal wall. Both kidneys anchored. Patient became pregnant immediately afterward and within a year bore a child, after which the uterus developed a hemorrhagic condition which produced a profound anemia (30 per cent hemoglobin). The fundus of the uterus was removed in March, 1910. At this time the hammock made at the operation in September, 1908, was inspected. The blending between the omental and parietal peritoneum

was perfect and continuous across the abdomen, corresponding to the entire length of the line of sutures placed at the time the hammock was made. No stretching had taken place. Three years after the hammock operation X-ray pictures were taken, as shown in Figs. 113 and 114. This patient was seen personally February, 1922, when she said she was in perfect health as far as her abdominal organs were concerned, just fourteen years after the operation.



FIG. 111.—STOMACH IN CASE 21, THREE AND ONE HALF YEARS AFTER "HAMMOCK" OPERATION. Dotted white lines indicate position before operation. (Typical Glenard's disease.) Improved, but not cured.

My thirty-third case of ptosis—fourth case of general ptosis—operated upon was Mrs. L. I. D., October 7, 1911. Widow, age fifty, had had several children. Health had been fairly good until seven years previous to operation. Began to lose strength and flesh at that time, condition gradually becoming worse, until the patient became a complete bed invalid. She had lost much flesh, her tissues were relaxed. Both kidneys were low down in the abdomen.

At the first operation both kidneys were fixed. Ten days later the gastro-hepatic omentum was shortened. The great omentum was sutured to the abdominal wall all the way across, making a complete partition in the

abdomen; the upper abdomen was expanded; the lower abdomen contracted. Patient had trouble with intra-abdominal tension for a few days but recovered on time and began to gain flesh. She was seen personally eight years after the operation, was in perfect health, earning her living as a telegraph operator. This patient was a potential ptotic from birth, but because of a considerable amount of fat with otherwise general good health and well-being, the organs remained in their normal position until the patient was nearing the climacteric,



FIG. 112.—COLON IN CASE 21, THREE AND ONE HALF YEARS AFTER "HAMMOCK" OPERATION AND NINE AND ONE HALF HOURS AFTER BISMUTH MEAL.

(Typical Glenard's disease with slight hypermotility.) Improved, but not cured.

when her general health began to decline. From this time, she lost her flesh and all the organs went down. She had not developed the typical ptosis habit for the reason that the organs had not gone down in early life.

Since that time, I have done a number of other complete operations of this kind, some of them on young individuals in the state of early adult development. These young patients were operated upon for early painful conditions in which a diagnosis of organic pathology had been made, usually the diagnosis of "appendicitis." The kidneys in these young patients had pro-

lapsed to a moderate degree only. In some of them, bands were in the stage of acute formation. These surgical operations have been the most satisfactory I have ever done.

In considering the technic of the surgery when indicated in these extreme cases of general ptosis, we necessarily reach out into all the other forms and fields of surgical treatment of ptosis. In this chapter, therefore, we will describe only those procedures especially required for the treatment of general ptosis.



FIG. 113.—STOMACH IN CASE 22, THREE YEARS AFTER "HAMMOCK" OPERATION.

White dotted lines indicate relative position before operation. Symptomatically cured. (Case I of acquired general ptosis.)

Bilateral floating kidneys, as stated before, are a pathognomonic sign of general ptosis. Longyear's work, while incomplete, I believe represents one of the fundamental ideas of the treatment of ptosis. As stated in a previous chapter, the ligament which he has described as "nephrocolic ligament" is made up of fibrous connective tissue which probably represents crystallized lines of force laid down to maintain a connection between colon and kidney in case of mobile cecum, and is only present in such cases. It is, therefore, not a normal part of the human anatomy. That it is often, if not always, present in cases of floating kidneys has been proved by a number of observers. That this tissue is sufficient to hold up the colon to a considerable

degree when used in the operation for floating kidney has been proved by Longyear and a number of other operators. The operation is fundamental but incomplete. In consideration of the subject in this monograph, however, I feel that a description of Longyear's operation is necessary, both because it represents a fundamental principle and because one can easily imagine circumstances under which it is advisable to do the Longyear operation, thereby avoiding opening the abdomen. While Longyear's clinical report deals only with right-sided ptosis, his principles would apply equally well to the left side



FIG. 114.—IN CASE 22, BISMUTH HAD PASSED INTO THE RECTUM WHEN PICTURE WAS TAKEN.

in general ptosis. In order more definitely to give Longyear's⁴ conception, I quote the following concerning operative treatment of nephrocoloptosis:

"Any surgical treatment of nephroptosis which ignores the accompanying and *causative* coloptosis must fail as a therapeutic procedure. A moment's glance at the anatomic relations of the parts involved is all that is necessary to confirm this observation. Strip the fatty capsule from the kidney, fasten the kidney to the muscles of the loin or other tissues in that region, and what happens? The *floating kidney* may be cured, anatomically speaking, but the

⁴ Monograph on "Nephrocoloptosis" published by C. V. Mosby & Co., St. Louis.

patient is not, as nearly all the symptoms, but especially the digestive and nervous symptoms, not only continue as before, but become even more aggravated. This is due to the connection of duodenum and ascending colon by the fatty capsule, the framework of which forms the nephrocolic ligament. The result of freeing the fatty capsule from the kidney is to increase the mobility of the ascending colon and cecum, so that the traction exerted by the large intestine on the duodenum not only continues in force, but is augmented. All symptoms would then be aggravated, excepting possibly those which may have been due to Dietl's crisis.

"The principal cause of the frequent failure of the usual operation of nephropexy is thus explained.

"As the first step toward nephroptosis is made by the relaxation of the hepatocolic ligament and the consequent increased mobility and dropping of the ascending colon and cecum, so must the first step toward a surgical cure be either the restitution of this support or the creation of a substitute for it, which shall do its work in the prevention of the downward drag of the colon on kidney and duodenum. It seems, therefore, that the prime factor in the surgical therapeutics is *fixation of the colon*, and that fixation of the kidney is of secondary importance."

Technic of Longyear's Operation.—"The incision, about two and a half inches in length, is begun just over the lower margin of the twelfth rib, and at the outer margin of the quadratus lumborum muscle—which point is a little over two inches from the vertebral spine—and carried a little diagonally outward toward the iliac crest. Skin, fat and superficial fascia are severed, when blunt dissection is used through the latissimus dorsi muscle to the transversalis fascia, which is grasped by two Kocher forceps and incised between; or the fascia may be entered also by blunt dissection by thrusting through and opening the hemostatic forceps. The subperitoneal (not perirenal) fat appears. Retractors are inserted and the fat pushed downward with the finger, when Gerota's capsule (perirenal fascia) is seen at the upper angle of the wound, near the twelfth rib, as a pinkish-colored membrane, somewhat resembling peritoneum. This is grasped with the two fine-toothed tissue forceps and incised between, when the perirenal fat appears. If incision has been made through the transversalis fascia too far downward, and not near the twelfth rib, the peritoneum, and not Gerota's capsule, will be opened at this stage of the operation. The index finger is inserted through the opening in Gerota's capsule, and the lower pole of the kidney located—and it is important that the lower end of the kidney be made out definitely, as the nephrocolic ligament, if grasped and fixed at the side of the kidney, is secured in but a small part and will have little supporting strength. With the end of the finger against the lower pole of the kidney acting as a guide, the long Kocher forceps are thrust deep in beside the finger and about an inch below the kidney, opened wide, transversely to the axis of the kidney, and the tissue below the finger grasped by gently closing the forceps. Traction indicates to the finger the success or failure to locate the ligament. If properly held

by the instrument, the kidney may be pulled up forcibly against the finger by it, and the fasciculi of the ligament may be felt to pass from the forceps to the kidney. Several attempts may be made, in some cases, before the ligament is satisfactorily secured, but it is usually found at once. Occasionally the kidney lies low, or in such a position that the examining finger cannot reach the lower pole, in which case two forceps may be used, and the kidney brought up by a 'climbing' process, so that the ligament below the pole may be reached. When secured, the kidney is pulled up to the wound. This spreads out the fasciculi of the ligament in a fan-shaped manner, as the inner side of it is adherent to the peritoneum between the kidney and bowel. To gather together these separated fasciculi into one mass of parallel fibers is the next step, which is accomplished by means of the forceps-hook. While the assistant holds the ligament gently taut with the long Kocher forceps, the closed hook is passed, with the finger as a guide, into Gerota's capsule anterior to the ligament and about an inch below the kidney, and pushed gently backward slightly beyond the lower pole of the kidney, the end being held upward, so that the hook lies parallel with the kidney. After it is placed in this manner, the end is turned toward the back of the patient, so as to cross the back of the ligament with the hook, and then drawn upward toward the wound. The finger, being removed at the same time from the anterior side of the ligament and placed on its posterior side—still within Gerota's capsule—guides the end of the hook up out of the capsule and forces it through the tissues clinging to it. Examination is then made, and, if a good mass of tissue has been secured which pulls strongly on the kidney and holds it firmly up to the wound, the hook is opened about an inch, which strips some of the ligament from the peritoneum and forms a loop through which the fascia and capsule are to be sutured. After opening the forceps once, they are allowed to close, and are opened only when necessary in passing ligatures under and drawing the edges of the capsule through. Some tough tissue is usually brought up on the tip of the hook, which is the part of Gerota's capsule that passes down with the ligament to its insertion in the bowel, and should be included with the ligament, as it materially strengthens it.

"The next step is the suturing of the overlapped margins of Gerota's capsule under the loop of ligament. For this purpose a mattress stitch of catgut is used on each side, the first being passed twice through the free margin of the capsule on the abdominal side, the long ends brought through the loop of ligament under the hook with the curved ligature carrier, passed under the capsule on the vertebral side, and with the handled needle the separate ends passed through the capsule and tied about half an inch from the margin. A similar ligature is then made fast to the margin of the capsule on the vertebral side, the ends threaded through the eyes in the end of the hook and the hook withdrawn, bringing the catgut through under the ligament with it, when it is passed through the outside of the capsule on the abdominal side, about half an inch from the margin of the loop of ligament and tied under the edge of the flap. The loop of ligament is still

held by the long Kocher forceps, which are not removed till the suturing around the ligament is finished.

"The opening in Gerota's capsule at each end of the projecting tissue of the ligament is closed with ligatures, after which the silver wire mattress suture is passed with the handled needle through the transversalis fascia from side to side, broadly, under the loop of ligament and fastened, thus bringing the margins of the fascia under and firmly against the tissue of the ligament. The wire is made fast by twisting the ends, and a small perfor-

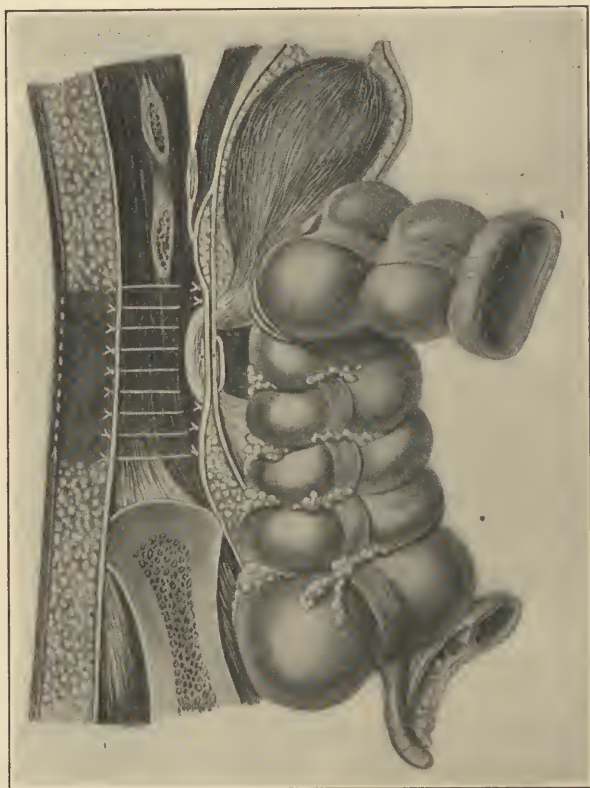


FIG. 115.—LONGYEAR'S OPERATION OF NEPHROCOLOPEXY.

This shows completed operation and method by which both bowel and kidney are supported by fixation of the nephrocolic ligament by the use of Gerota's capsule and the transversalis fascia. For anatomical description, see Longyear's monograph.

ated silver shot run over the ends down to the shoulder and crushed with the shot-crushing forceps. The ends of the wire are cut flush with the shot, which leaves the suture in a condition free from any possibility of causing irritation to the tissues. No postoperative trouble is had with this buried suture made with this size of wire, protected by the silver shot. Further closure of the transversalis fascia is made with interrupted catgut sutures.

"The long Kocher forceps are removed from the ligament, which is now covered over by the closure of the muscle and superficial fascia by inter-

rupted sutures, care being taken here—as, in fact, during the entire operation—to leave no dead spaces or bleeding points” (Fig. 115).

The results of Longyear’s work and his technic, beautifully illustrated, will be found in his monograph, which should be carefully read by every student of this subject. This report is very encouraging and gives positive evidence of the real merit of his work.

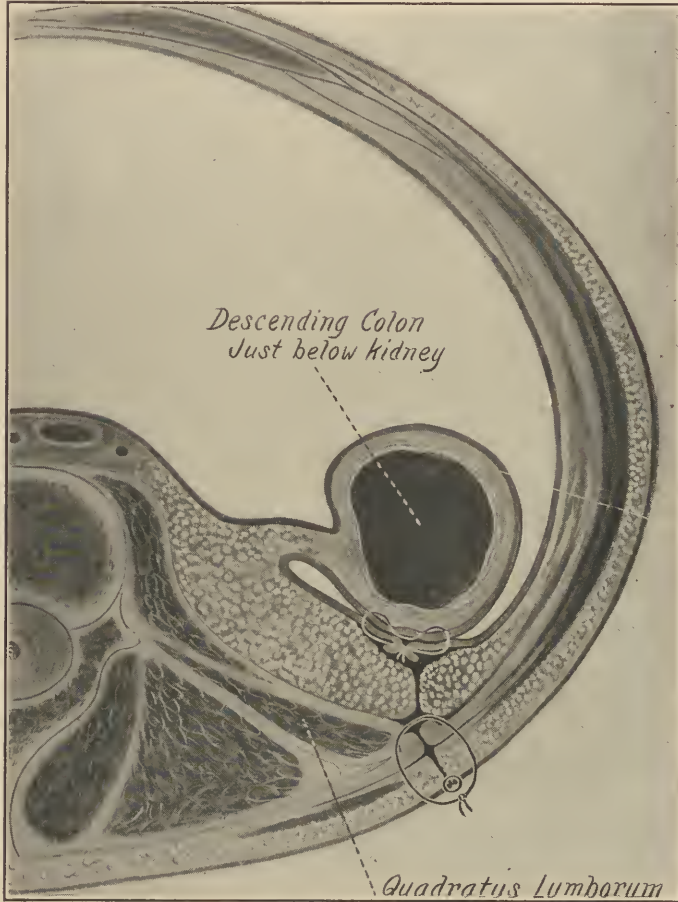


FIG. 116.—THE MOBILE COLON IS SUTURED TO THE POSTERIOR PARIETAL PERITONEUM AS THE INCISION THROUGH WHICH THE APPENDIX WAS REMOVED IS BEING CLOSED.

While I have verified the soundness of Longyear’s principle, I have never used his exact technic, although I am sure it has a very important place. Before the issue of Longyear’s book, in which his operation was described, I had done a similar operation in effect. Through the usual kidney incision, the peritoneum was opened and the appendix removed. The ascending colon was then sutured to the peritoneum along the edges of this incision (Fig. 116), after which the kidney fixation was performed. In certain cases of

general ptosis, even when it is necessary to do an intra-abdominal operation, a kidney which has been long displaced and painful should occasionally be fixed.

The operation I have found most satisfactory for fixation of the kidney is a modification of the one described by Dr. B. B. Davis, of Omaha, many years ago and is performed as follows: The fatty capsule is carefully opened and pushed off the kidney; the kidney is brought up into the wound and an incision about an inch and a half long is made through the fibrous capsule

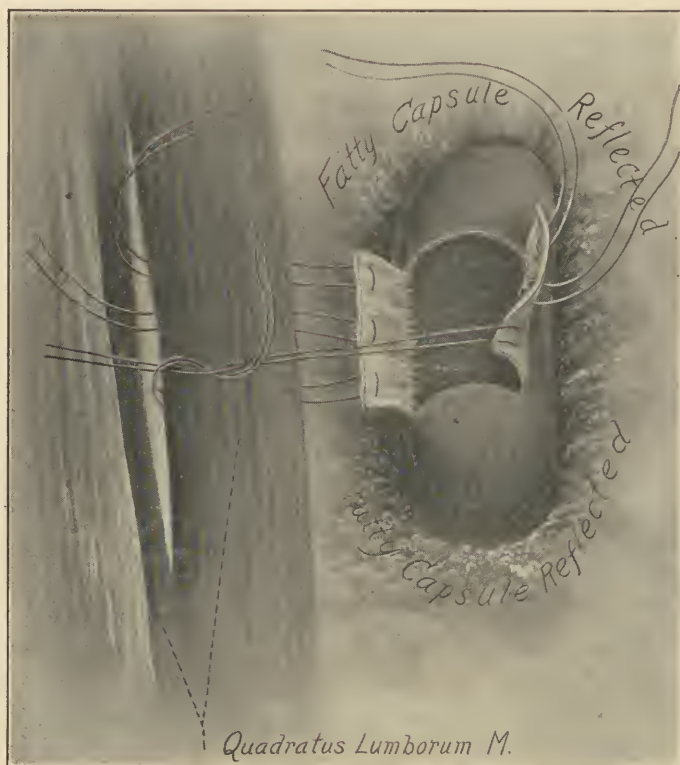


FIG. 117.—SUTURES PLACED FOR FIXING FIBROUS FLAPS OF THE KIDNEY AROUND A DETACHED PIECE OF THE QUADRATUS LUMBORUM MUSCLE.

on its convex border. From the ends of this incision, right angle incisions are made in the fibrous capsule toward the pelvis on each surface. These flaps are easily separated from the kidney substance. Three quilt sutures of chromic catgut are passed through each flap in the form of a loop and held in forceps (Fig. 117). A strip of muscle the size of a man's middle finger is split off the quadratus lumborum, leaving the two ends attached. The sutures in the fibrous flap nearest the spine are drawn through this slit in the muscle, after which the kidney is slid upwards along the muscle. The opposing sutures of the two flaps are then drawn around the muscle and tied, care being taken not to strangulate the muscle.

Several other sutures are taken in the edge of the fibrous capsule which has not been lifted from the kidney at the ends of the denudation and fastened to the muscle. This operation brings the kidney substance in direct contact with the muscle and utilizes the fibrous capsule as a handle swung around the muscle and held by the sutures described. The fatty capsule is then drawn around the muscle in like manner, made taut and sutured (Fig. 118). Contrary to the observations of many authors, my experience with operations

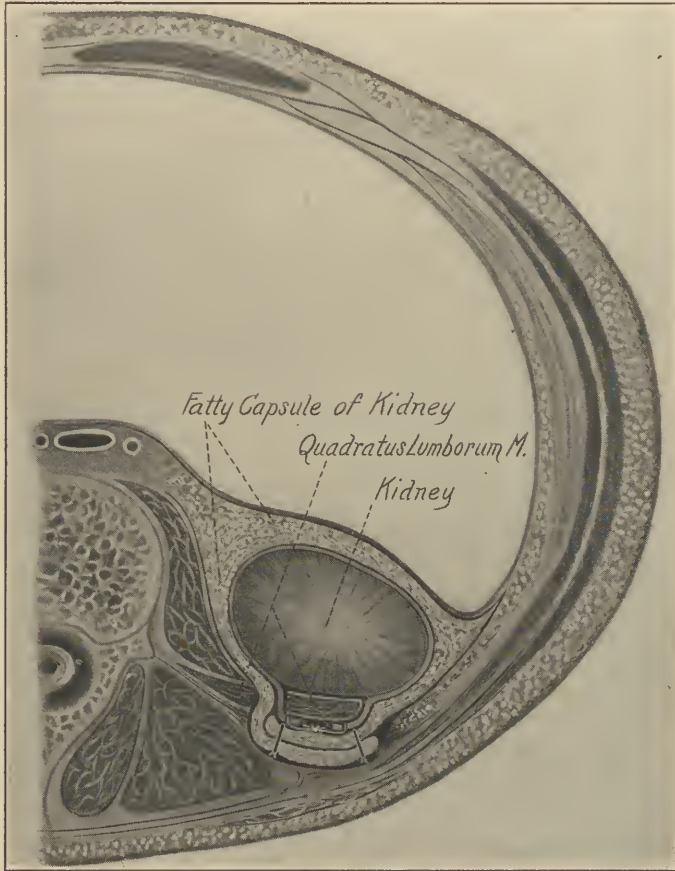


FIG. 118.— SCHEME OF COMPLETED OPERATION OF SWINGING FLAPS OF THE FIBROUS AND FATTY CAPSULE OF THE KIDNEY AROUND A PIECE OF THE QUADRATUS LUMBORUM MUSCLE.

for floating kidney has been almost uniformly satisfactory, although I do not frequently do the operation. It is my opinion that this operation has been poorly done quite generally. The principle which we must always bear in mind is that we are dealing with an abdomen that has become permanently narrowed above. We, therefore, must not fix the kidney as high as the normal kidney. A kidney should never be fixed above the rib arch but should always be palpable in its fixed position after the patient has recovered from the operation. I have never known a kidney fixed in this way to come

down or give pain. However, we rarely do a posterior operation now, or even touch the kidney except in the most extreme or painful cases, or cases in which hydronephrosis is or has been present. Hydronephrosis in these cases is usually brought about by an anomalous artery which serves as a cord over which the prolapsing kidney falls, producing kinking and obstruction of the ureter. Such a condition usually calls for surgical interference which may be fixation of the kidney, or severing the vessel, or both. There is no

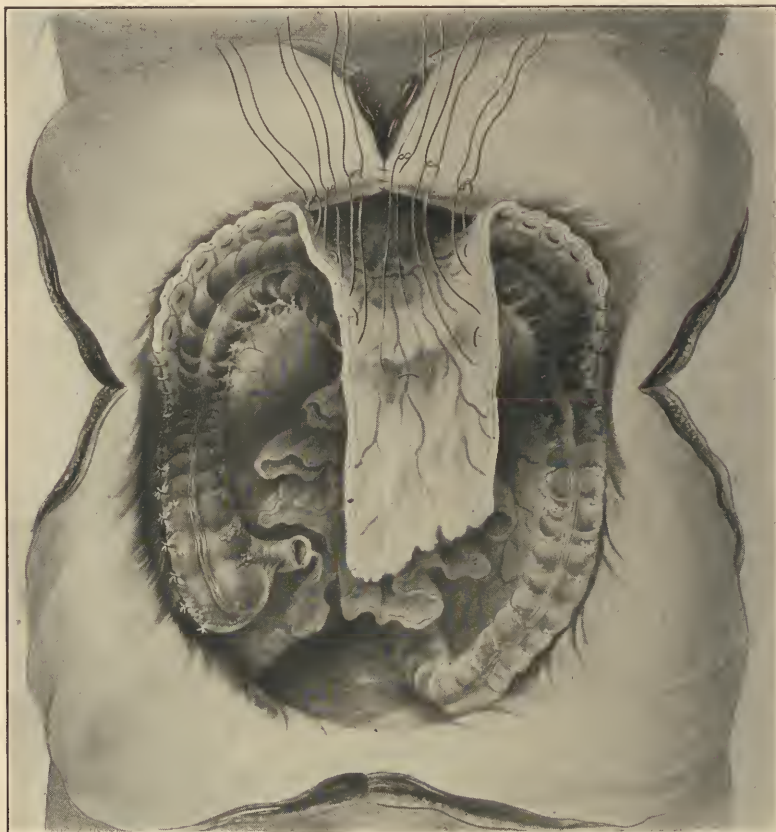


FIG. 119.—COMPLETE HAMMOCK OPERATION USED IN GENERAL PTOSIS.

This is a combination of the cecal fixation of Klose and the original hammock operation, which I described, plus closure of the spaces on the two sides. After union, this forms a water-tight partition in the abdomen.

feature in the ptosis question which responds more satisfactorily to postural or fattening treatment than the ordinary floating kidney going with general ptosis. Therefore, when surgery is necessary, the operation of choice is intra-abdominal shortening of the mesentery of the ascending colon (for technic, see Figs. 128, 129, 130), and suturing of the omentum to the abdominal wall entirely across the abdomen. This makes a complete partition over to and including the costocolic ligament, which combined operation is shown in Fig. 119. In general ptosis, it is frequently found that the liver

is prolapsed as in midline ptosis, in which case it is fastened to the anterior parietal peritoneum with sutures as indicated in Figs. 152 and 153 in Chapter XIII. Fig. 153 also shows the shortening of the gastrohepatic omentum by the Beyea method, which procedure is also advisable sometimes in general ptosis.

In extreme cases of general ptosis, it is an easy matter to rearrange the capacity of the abdominal cavity as a supplement to the internal suspension

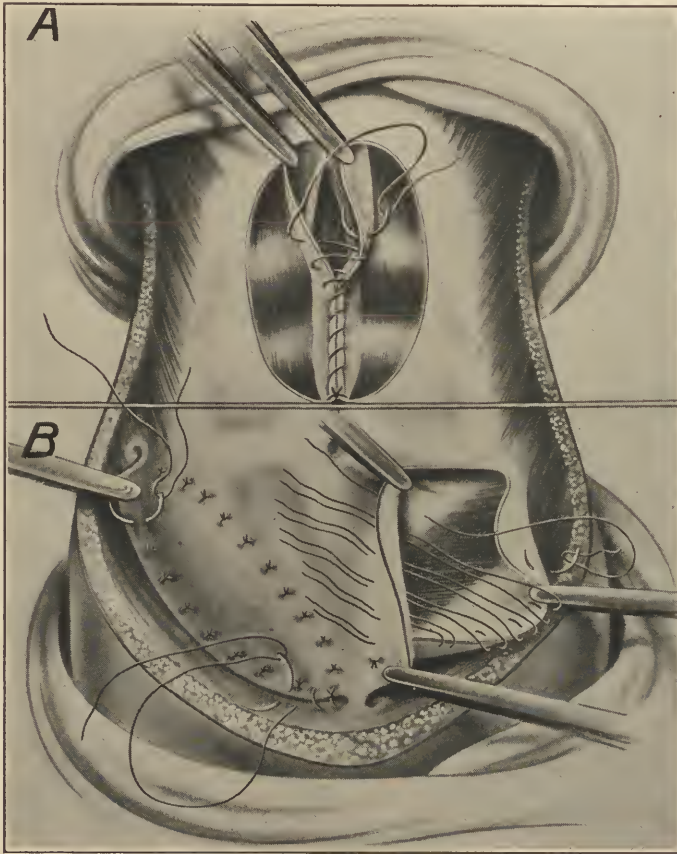


FIG. 120.—EXTREME CASE OF GENERAL PTOSIS.

The anterior aponeurosis (A) of the external oblique has been cut and reflected inward. The reflected edges are being sewed. The tendon of the external oblique (B) has been split and the flaps are being imbricated, thus narrowing the lower abdomen and making autoplasmic bandage.

operations by expansion of the upper abdomen as follows: Make an incision through the skin and fat down to the aponeurosis, dissect the fat off the aponeurosis for an inch or more on either side of the midline; open the fascia in the exact midline, taking great care not to open the sheath of either rectus muscle, split the anterior sheath of each rectus muscle an inch or more from the median incision; dissect the aponeurosis off from the muscle and reflect toward the median line. Pass silkworm sutures through skin, fat, a bit of

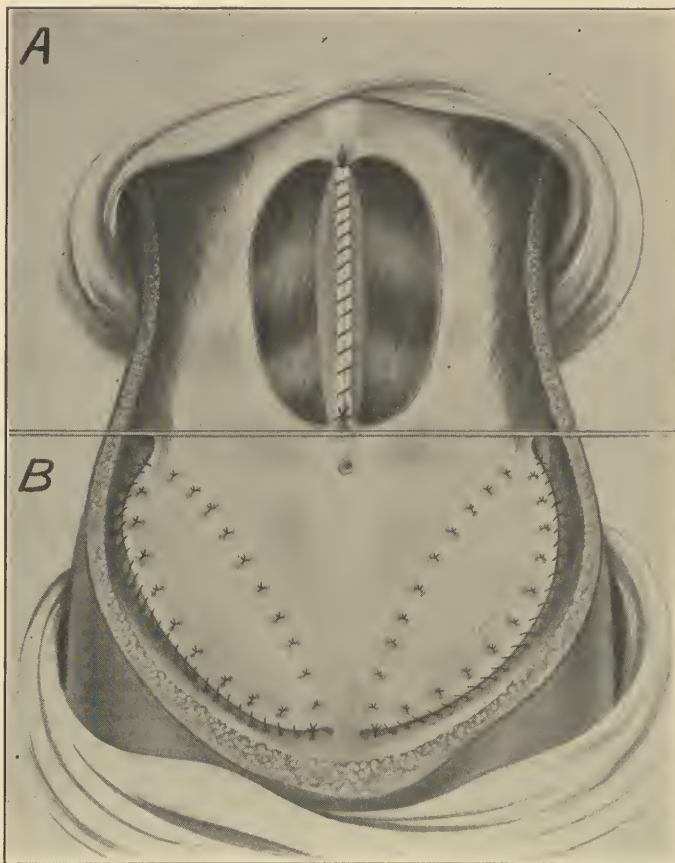


FIG. 121.—EXTREME CASE OF GENERAL PTOSIS.

Upper abdomen expanded. (A) Contraction of lower abdomen completed forming auto-plastic bandage. (B) (Pictures 120 and 121 first published in *Surgery, Gynecology and Obstetrics*, January, 1910) 10:91.

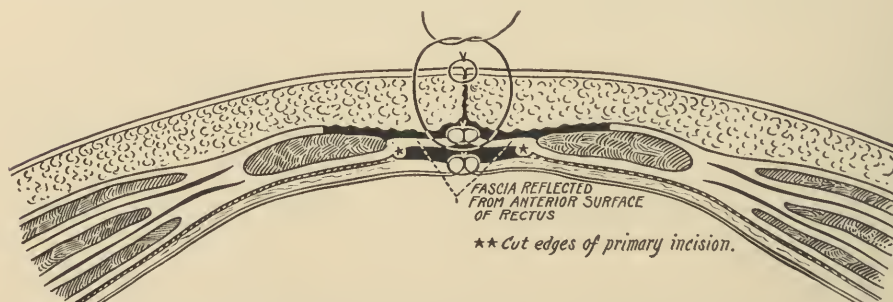


FIG. 122.—CROSS-SECTION OF THE UPPER ABDOMINAL WALL.

This gives scheme of operation for expanding upper abdomen shown in Figs. 119 and 120.

muscle and reflected flap of aponeurosis and leave the ends to be tied after other layers have been sutured. Bring the reflected edges of the fascial flaps together and suture in the median line with chromic catgut, including some of the muscle fibers of the rectus muscle, leaving the front surface of the recti muscles bare and the original median cut through the conjoined aponeurosis unsutured. Suture skin with horsehair and the silkworm sutures over gauze. It is well to place small drains through stab wounds, in the skin on either side of the central incision, if the wound is not entirely dry when closed (Figs. 120 A, 121 A and 122). This operation of expanding the upper abdomen is often used in midline ptosis.

In the large, pendulous, dilated abdomen, sometimes accompanying long-standing general ptosis, it is wise to contract the lower abdomen as follows: First, split the fibers of the aponeurosis or tendon of the external oblique muscle parallel to its fibers in such a manner as to converge with a like split on the opposite side at a point just above the symphysis. Second, separate this tendon from the internal oblique muscle. Third, draw one layer under the other with quilt sutures of linen. Fourth, suture the remaining free edge of the fascia to the outer surface of the other layer with another line of quilt sutures of linen or chromic catgut and finally with a continuous catgut for approximation. The result is an abdominal supporter made of the patient's own tissues; consequently it may be designated an "autoplastic bandage" (Figs. 120 B and 121 B).

In recent years, we have been convinced that it is possible, by the postural methods of Goldthwait and Martin, to materially expand the upper abdomen and to greatly strengthen by exercises the lower abdomen, which answers much the same purpose as the operation when it is successful.

In this form of ptosis, increase of intra-abdominal pressure by fattening, strengthening of the abdominal walls by exercises, and regulation of the bowel by noncathartic measures constitute the essentials of postoperative treatment (see Chapter XVI on Medical Treatment).

CHAPTER XII

RIGHT-SIDED PTOSIS

Right-sided ptosis is that division of congenital ptosis in which the fixation and supports of the splenic flexure have remained firm and potent while the defectively attached cecum and ascending colon have gone down with or without prolapse of the right kidney. The sequential phenomena of right-sided ptosis vary according to the extent of defect of prenatal peritoneal fusion.

If the ascending colon has been largely fixed, leaving a pendulous cecum, the changes are local. These changes are usually limited to a baggy dilatation of the cecum which falls over the psoas muscle. It probably gives trouble only in combination with habitual constipation, in which case a painful, sore condition sometimes exists. It is probable that this type usually passes unnoticed, and has been classed by the surgeon as "normal."

In the second degree of nonfusion, the cecum and ascending colon have a mesentery, the colon has become fixed to the front surface of the kidney, thus locating the hepatic flexure about an inch farther front than normal, making the drop of the movable cecum and ascending colon correspondingly more perpendicular.

Many of these cases pass unnoticed as long as the patient has good health and normal intra-abdominal pressure. Some of these cases develop the following sequential phenomena: In childhood, the patient is constipated, presents frequent gastro-intestinal disturbances and sometimes right-sided abdominal pain. As a rule, however, this development is reserved for adult life. When the patient, who in 80 per cent of cases is a young female, begins to assume the erect posture for a long period during each day, it seems that the strain on the supports of the intestines produces an irritation in the suspending tissues which causes a deposit of some substance which, under proper circumstances, is capable of being organized into membranes or bands. During the pouring out of this substance and the process of formation of this new tissue, a painful process often develops in the right side of the abdomen. This pain begins with attacks which are usually diagnosed "appendicitis." These attacks recur and gradually the pain becomes constant. The patient is operated upon with pre-operative diagnosis of "appendicitis." On opening the abdomen, the surgeon finds a mobile cecum and ascending colon. Usually the appendix is uninvolved. At times, it is found that the appendix, while not diseased, is attached near its tip to the posterior parietal peritoneum high up under the liver and is acting as the only external

ligament of the cecum. At other times, although not diseased, it may be found attached to the mesentery of the terminal ileum and acting as a suspensory ligament supporting the cecum mesially. Occasionally, such an appendix will be found distended and diseased beyond the most fixed point of its attachment.

Regardless of the appendix, it is frequently found that the peritoneum of the cecum, corresponding to the point where the cecum passes between the psoas muscle and the abdominal wall, shows an edematous, red, inflammatory development. This development seems to extend along the mesentery diagonally upwards and outwards along the parietal peritoneum. If the patient is seen at a later stage, this edematous development has been transformed into a membrane. This membrane is sometimes continuous, at other times it has formed itself into bands, or bands combined with a membrane.

The removal of the appendix relieves symptoms only in those cases in which the appendix is acting as a ligament and is actually diseased, and this relief is often only temporary, as indicated by the fact that 70 per cent of all cases going through our clinic who were operated on elsewhere for chronic appendicitis in years gone by have not been relieved by the operation.

Upon continuation of the process, the fixation of the colon to the front surface of the kidney becomes more firm, thus adding to the sharp angulation and increasing the difficulties of the cecum and ascending colon in propelling the contents forward. At other times the weight of the colon drags the kidney out of its position, producing a right floating kidney. This drag on the kidney by the colon, and the consequent crystallization of the lines of force given in Lane's law, has produced such an aggregation of fibrous tissues in many cases, that Longyear, in discovering it as an accompaniment of floating kidney, termed it the "nephrocolic ligament." This development of ligament is never found in a subject with normal peritoneal fusion. The intraperitoneal membranes previously described are rarely formed in patients with normal peritoneal fusion. That these membranes and bands are conservative and beneficent in function is proved by the fact that they often return after they have been cut, and, with their return, the symptoms also return.

This type or degree of right-sided ptosis, if the kidney remains fixed and the colon maintains its attachment to the kidney, rarely produces upper abdominal symptoms, although occasionally it may make tension on the superior mesenteric artery. On the other hand, if the kidney has been pulled out of position, a secondary drag on the duodenum may be instituted.

In the third degree of nonfusion, the colon has not reached as far as the right kidney, but has attached itself to the peritoneum on the front of the duodenum, from which the cecum and ascending colon make a direct drop and consequently a direct drag on the second and third portions of the duodenum and attached ducts. This attachment is often made stronger by the crystallization of lines of force which have extended upwards and have attached in certain instances to the under surface and tip of the gall-

bladder. In other instances, this development has taken place upwards over the duodenum and has produced bands across it, even going as far as the lesser omentum in some instances.

This type of development, in addition to producing general intestinal stasis, produces symptoms which frequently lead to the diagnosis of gall-stones in what proves to be a perfectly normal gall-bladder and a duodenal ulcer in what proves to be a normal duodenum. In this type of cases, there is still greater tendency to make traction on the superior mesenteric vessels and thereby produce chronic duodenal arteriomesenteric ileus. In this type of cases, the mesentery is longer and bands external to the colon are less frequent. Floating kidney usually does not occur.

In the fourth type of right-sided nonfusion, there has been no fusion of the ascending colon or its mesentery. The intestine is suspended by long mesentery just as in the quadruped. The duodenum has usually rotated and fixed to the posterior parietal peritoneum, but is not covered by the mesocolon and from an abdominal incision it appears in plain view for its whole length.

In this type of cases, membranes are rare. The omentum coming off from below the pylorus has sometimes taken on extraordinary development and includes crystallized lines of force which have developed for the purpose of rescuing the transverse colon from descent.

In this type of cases, the ascending colon and cecum are usually dilated but not to the same extent that is seen in the previous types in which the hepatic flexure has been located and fixed. It is probable that this type also strongly predisposes to traction on the superior mesenteric vessels and consequent duodenal arteriomesenteric ileus. In right-sided ptosis, long-continued constipation with gas distention of the cecum causes the cecum and part of the ascending colon to become dilated. The opening in the side of the intestine, through which intussusception of the end of the ileum has been thrust, becomes correspondingly larger. The constant gas pressure in the torpid dilated cecum gradually overcomes muscular action and reduces the intussusception and destroys the ileocecal valve. This permits the heavily laden bacterial and putrefactive contents of the cecum to flow back into the absorbing part of the small intestine, many times to the detriment of the patient.

In the harmful cases of this type, it is probable that something has gone wrong with the motor apparatus of the small intestine, which allows it to remain dormant or even under certain circumstances to propel the contents upward by reverse peristalsis, although this feature has not been satisfactorily proved. This condition probably takes place rarely except in the presence of mobile cecum.

Harmful Acquired Membranes and Bands.—I believe with Lane that these membranes are crystallized lines of force laid down in response to a strain or a demand for help by the supporting tissues. Therefore, their purpose is conservative and beneficent. They are laid down for the purpose of remedying a defect in embryological development. If the development of

the membranes has been symmetrical, they often serve the purpose for which they were called out in a satisfactory manner. Unfortunately, these membranes frequently develop unevenly, and their forces are concentrated into small firm bands. In this instance their support is confined to narrow limitations in which the pull becomes definitely localized in one place, which in turn calls forth more material for crystallization and for strengthening this one place, and which in turn creates a stronger local pull, and so a vicious circle is established. This development often continues to great proportions, even to the point of partially cutting off the lumen of the bowel.

The most striking case of this kind I have been called upon to treat was in the person of a friend who was a doctor. He was operated upon November 12, 1915, with the following history: Age 46, well as a child, had trouble with his right side since a very young lad; his appendix was removed at the age of 19 by Dr. Deaver without much relief; had been constipated for twenty years and had used cathartics constantly. When taking vigorous exercise, he felt fairly well, but as soon as he began leading a sedentary life, his stomach trouble and intestinal symptoms returned. Gas would accumulate in the cecum, causing great distention and pain. After the abdomen was opened, it was seen that a number of strong acquired bands attached the ascending colon to the parietal peritoneum at intervals during its entire length. At the junction of the upper and middle third of the ascending colon, a very strong band had developed and completely surrounded the intestine. This band included fibrous connective tissue, fat and blood-vessels of considerable size. At the hepatic flexure a very strong band, including both fat and blood-vessels, was also noted. At the operation, this firm band around the ascending colon and also the extra development at the hepatic flexure were dissected away, exposing and freeing the upper end of the ascending colon. After the colon had been thus freed, the mesentery of the ascending colon was sutured firmly to the lateral parietal peritoneum. This line of sutures extended forward around the anterior abdominal wall to the beginning of the omentum, which was sutured to the abdominal wall over to the median line. The patient had a great deal of trouble with gas immediately and for several days following the operation. He soon recovered and went home.

During the next four years, I saw him frequently. He came to my office several times to express his great satisfaction with the results of the operation.

In October, 1919, he began to experience pain and evidence of return of his obstruction. Gas distention had increased. During February, 1920, he developed absolute intestinal obstruction. Finally he began to vomit fecal matter. Being a day's ride away from Portland, he delayed operation until he had had obstruction nearly four days. He was operated upon soon after his arrival. A total obstruction was found. The obstruction was due to re-formation of the band which I had dissected away at the former operation but it was even stronger. The intestine below the constricting band was normal and more or less collapsed. Above the constricting band, the intes-

tine was very much distended. The cecum and most of the small intestine had almost reached a state of gangrene. There were a number of dark spots on the cecum and also on the small intestine so that it was necessary to empty the intestine through an opening into which a tube was inserted. After thus emptying the intestine, an anastomosis was made between the cecum and the collapsed transverse colon.

The patient did well at first. At the end of ten days he was eating very well but on the thirteenth day he began to show evidence of peritonitis, although there was no vomiting or other obstructive symptoms. He died two days later.

Postmortem revealed eight perforations of the small intestine. These perforations apparently corresponded to dark spots noted at the time of operation. The hammock operation which had been done four years ago was a success. Everything was satisfactory except that the band high up on the ascending colon which had been removed at the former operation had reformed and strengthened itself until it finally produced a definite and complete obstruction.

I believe it has been the experience of all operators that the mere cutting of bands gives only temporary relief. After the christening and illustration of "Lane's kink" by Dr. C. H. Mayo, surgeons all over the world felt that at last something very definite had been given us. It was found very frequently holding the ileum down to the parietal peritoneum below the cecum. A great many surgeons, including myself, began to cut this membrane and free the ileum, obtaining what appeared to be temporary relief from the symptoms. I went to the extreme of calling in a number of my uncured patients on whom I had operated unsuccessfully for chronic appendicitis and suggested a second operation for the purpose of cutting these bands. Some of these patients seemed to be temporarily relieved. After a few months following this second operation, nearly all the patients began to complain of the same old trouble. It is very rare that I have noted complete relief from symptoms manifested in the ileocecal region by the cutting of bands and membranes. The experience of Walton, reported later in this chapter, is one of the most perfect demonstrations of this fact. The cutting of these membranes and bands temporarily produces relief by completely thwarting the plans of nature. These bands are usually re-formed and, with their re-formation, the symptoms return. The best means of *checking the formation of these membranes is to relieve them of their burden* by creating a uniform attachment over a sufficient area to give easy and even support. In other words, *these membranes and bands as a rule should be extended over a wider area rather than destroyed*. Under certain conditions, it is necessary to cut them in order to procure a coördinate adjustment of organs. In individuals with normal intra-abdominal pressure and intra-abdominal fat, the call for these membranes is not so strong even in the presence of a marked defect in peritoneal fusion. The development of membranes is, therefore, not so marked and the clinical picture often fails to develop under these circumstances.

Right-sided Pain with Right-sided Ptois.—As early as 1908, Wilms¹ reported 40 cases in which he had fixed a movable cecum for the relief of chronic appendicitis and expressed the belief that in many cases of supposed chronic appendicitis the symptoms were in reality due to gynecologic or neuralgic conditions, or to abnormal mobility of the cecum. At that time he described his method of making a large pocket in the retroperitoneal space into which he pushed the unduly long and movable part of the cecum. He fastened the corner of the peritoneum left from his triangular incision to the anterior parietal peritoneum. By this method he depended on adhesions to form over the surface of the cecum and hold it firmly without suturing. He reported excellent results.

In another paper of 1909,² he reported 52 cases treated between 1907 and 1909. Seventy-five per cent of all the patients were freed from their disturbances, including their tendency to constipation.

Klemm³ presented a novel interpretation of the significance of a dilated mobile cecum in connection with chronic appendicitis. He ascribed the atony of the dilated cecum to some obstruction to the outflow of the secretion in the appendix. This resulted in slight inflammation, too mild to induce symptoms, but serious enough to injure the serosa of the cecum and impair the elasticity of the intestinal wall, which stretched and was followed by atony as the feces stagnated there. He recommended taking up a fold in the wall of the cecum (plication of the cecum).

Klose⁴ began to study these cases about the same time and as early as 1909 promulgated the view that the mobility of the cecum was an index of defective development, which might not cause any disturbance, and, on the other hand, might produce colics and inflammation, which he said could be remedied by a simple intraperitoneal cecopexy. In 1910, in another article, he attempted to distinguish between the disturbances in an abnormally movable cecum with chronic inflammatory conditions responsible for the stretching of the connective tissue from those disturbances due to anomalies in development. He contended that the developmental anomalies were much more frequent. He described the patient going from one physician to another, until finally he came to be regarded as a chronic neurasthenic or hysterical individual. In this article, Klose referred to complete torsion of the cecum in mobility. He stated that most of the disturbances persisting after appendectomy for supposed chronic appendicitis were due to mobile cecum. He examined his pathological records and found that 25 per cent of all his cases of alleged chronic appendicitis were due to habitual torsion of a long movable cecum. He described the attacks of pain in connection with the mobile cecum in which he stated the main features of the attack were colic with distention of the cecum, increased peristalsis, sounds on palpation, obstipation followed by diarrhea and the pain from the tugging and distention with partial stiffness of the intestines. He found this condition in children

¹ *Zentralbl. f. chir., Leips.*, September 12, No. 37, 35:1,089.

² *Arch. f. klin. Chir., Berl.*, No. 3, 95:495-741.

³ *Ibid.*

⁴ *Beitr. z. klin. Chir., Tübing.*, June, No. 3, 63:447-812.

in about 13 per cent of his total material. His treatment consisted of intra-peritoneal fixation of the cecum.

About 1907, I was called to operate on a member of the family of a surgical colleague who had intestinal obstruction and was in a very serious condition. She had had three previous operations for intestinal obstruction; at these operations the cecum had been replaced and bands severed. At the last attack preceding this one, the surgeon had removed the entire omentum, believing it was the cause of the obstruction. On opening the abdomen, I found a large, gangrenous, cystic mass which I first took to be an ovarian



FIG. 123.—GANGRENE CECUM AND ASCENDING COLON AND LAST SIX INCHES OF ILEUM RESULTING FROM TORSION OF MOBILE CECUM.

This patient had had three previous operations for intestinal obstruction due to band formation. Omentum removed at previous operation to prevent formation of bands.

cyst. On tracing it, I found it was a gangrenous cecum and ascending colon which had been twisted on itself sufficiently to produce gangrene. The segment shown in Fig. 123 was rapidly removed, tubes placed in the end of the ileum and transverse colon, after which the two limbs were sewed together and the wound packed with gauze. Later the septum was cut with a clamp by the Mikulicz method. As the wound healed, a fecal fistula was left which was later closed. The patient made a good recovery. I saw her personally only a few weeks ago. She has been in better health since the removal of the cecum than ever before. In fact, she is now well, whereas

before she was constantly sick with what we now recognize as intestinal toxemia. It is interesting to note that this patient had been operated on three times on former occasions for intestinal obstruction.

In 1911, Klose⁵ reviewed the ptosis question and discussed the subject from the standpoint of embryology, anatomy, physiology and symptomatology, especially the clinical picture of movable cecum. He reported 134 patients who had been treated in Rehn's clinic including 12 children; 75 per cent of the patients were under 25 years old. In 70 per cent the trouble was evidently of congenital origin. The main symptoms were intermittent afebrile and subfebrile colic pains like neuralgia, generally located in the right side. In this paper Klose remarks that the questions of "pseudo appendicitis" and "intestinal hysteria" need to be studied anew by the internists, as this assumption of a movable cecum has knocked out most of the foundation for them.

In the hospital reports of a few years ago, the tables showed from two to four operations for chronic appendicitis to one of acute appendicitis. This has been changed until now a well-conducted surgical clinic operates upon more acute cases of appendicitis than chronic.

A very interesting and instructive paper was published by Dr. Charles L. Gibson in May, 1920, in the *American Journal of Medical Sciences*. He based his study on two questions: First, how often does the removal of a supposedly diseased appendix fail to relieve symptoms or improve the patient's conditions? Second, what are the reasons for such failures and how can we avoid them?

Gibson in this article proves the soundness of the work of his clinic by showing that, in the period from 1913 to 1919, 555 patients in the ward service of the First Surgical Division of the New York Hospital were operated upon for chronic appendicitis while 820 operations were done for acute appendicitis. Of these chronic cases, even after such careful selection, about 25 per cent were unrelieved. The percentage of satisfactory cases showed 72 per cent for women and 88 per cent for men, leaving the unsatisfactory cases twice as great in women as in men, the prevalence bearing a striking relation to the relative prevalence of ptosis in women.

John A. Lichty,⁶ before the meeting of the American Medical Association, May, 1922, discussed chronic appendicitis, and called attention to the very large percentage of cases with pain in the right side usually operated on for appendicitis which was not manifest at the time of operation. In 517 consecutive cases, compiled from a general and consulting practice, the patients had already been operated on for various conditions and the complaints "after the operation were the same as before the operation." Of these 243 had been operated on for chronic appendicitis. Of the remainder, 78 were operated on for appendicitis and pelvic disease; 44 for appendicitis and gall-bladder disease; 47 for gall-bladder disease only; 41 for pelvic disease only; 16 for gastric ulcer only, and 39 for promiscuous

⁵ *Beitr. z. klin. Chir., Tübing.*, 74:1-754.

⁶ *Am. Med. Assoc.*, September, 1922.

conditions, including all kinds of operations. He concludes, therefore, that this is the most unsatisfactory surgery of the abdomen.

Compared with his results for acute appendicitis, that for chronic appendicitis was a great disappointment. In two of his tables, 1,440 cases were studied, 120 of which were diagnosed as acute and 1,320 as chronic appendicitis. He thinks it is probably safe to say that not more than 60 per cent of the diagnoses were justifiable clinically. The remaining 40 per cent may consist of patients who suffer from certain neuroses or who may have a pathologic condition elsewhere in the body. Patients with chronic appendicitis showed satisfactory results in about 60 per cent following operation. Some of these were not definitely cured but were better than before operation. Lichty asks the significant questions, "Why are the results so unsatisfactory? Why were there approximately 40 per cent of failures?" This is a difficult question to answer but it is no doubt the crux of the whole problem.

Lichty very wisely says: "It is not unlikely that many of the patients which the late Dr. Weir Mitchell treated so successfully with his system of 'rest cure' were cases which we now are too prone to call chronic appendicitis, and are attempting to cure by operation."

Lichty found 40 per cent of failures in his cases of chronic appendicitis which had been operated upon. My associate, Dr. Sears, some time ago went over many of our records and found that of the patients going through our clinic for routine examination who had had the appendix removed for chronic appendicitis elsewhere, 70 per cent had not been benefited. In going over our statistics and many of our histories, I am very sure that more than half of the patients coming with right-sided pain have no definite organic disease. A very large per cent of the right-sided abdominal pain is the result of defective fixation of the ascending colon. The pain is directly produced in two ways: First, by traction on acquired membranes or bands which help to carry the weight of the organs below. Second, by distention of a mobile, prolapsed cecum.

Two notable contributions by distinguished London surgeons have been published in the *British Journal of Surgery* bearing directly on this discussion, one by Walton⁷ and the other by Waugh.⁸ It is strongly recommended that these original articles be studied.

The principal feature in the therapeutic work of Walton was the cutting of bands and freeing of adhesions, while the principal feature in the work of Waugh consisted in fixing the cecum. It is quite apparent in reading the two articles carefully that they were dealing with exactly the same class of cases. Although one might be led to believe, in a casual reading, that there was a marked difference in the cases (for it will be noted that Walton found Jackson's membrane in almost all of his cases, while Waugh, in one place in his article, claims to have seen only one instance of Jackson's membrane in his more than 200 cases), this difference in findings is more apparent than real and is chiefly, no doubt, a difference in classification.

⁷ *Brit. Journ. Surg.*, 2:185.

⁸ *Brit. Journ. Surg.*, January, 1920.

Waugh has adhered to the letter of Jackson's description quoted in Chapter IX, while Walton has extended the meaning to cover most acquired bands and membranes. Jackson himself contends that the typical membrane he has described is quite rare. In order that the reader may have abundance of evidence on which to base his conclusion, I am reproducing in the language of the author much of the evidence submitted in these two articles.

Walton's article was published nearly five years before Waugh's article.

Walton wrote under the title of "The Clinical Aspects of Visceroptosis," and divided the subject into four groups: (1) cases resembling appendicitis; (2) cases resembling gastric ulcer; (3) cases resembling gall-stones; (4) cases resembling gastric carcinoma.

Waugh, writing under the title of "The Morbid Consequences of a Mobile Ascending Colon with a Record of 180 Operations," divides his clinical cases into five groups according to the character and localization of pain: (1) gastric; (2) duodenal; (3) biliary; (4) renal; (5) right iliac fossa.

It will thus be seen that the two authors are attempting to deal with the same problem. Walton assumes that the membranes are superfluous while Waugh tends to ignore them and assumes that more fixation is the patient's chief need. The two authors agree very closely in the presentation of their clinical pictures. In presenting to the reader a clinical conception, I can do no better than to quote largely from these two articles.

In a given period of time, Walton had 373 cases of true acute appendicitis. During the same period he operated 29 times on patients with a pre-operative diagnosis of "appendicitis" in which appendicitis did not exist. In 13 of these cases a diagnosis of acute appendicitis was made and, in 16, chronic appendicitis, but he says that this group does not include cases of true chronic appendicitis in which visceroptosis was also present. In the 13 cases of suspected acute appendicitis, he in every instance removed the appendix, although not diseased, and cut bands when they were present. Of the 13 cases, 7 showed evidence of recurrence sufficient to cause the patient to return for further treatment. These attacks, upon the return of the patient, were relieved by the use of liquid paraffin and the administration of abdominal massage and exercise, combined by using the abdominal belt.

He cites an illustrative case which gives an idea of the pathology and symptomatology present:

"Case I. C. P., male, age thirteen, stated that on August 14, 1914, there was a sudden onset of severe pain in the lower abdomen. At first it was most marked in the left iliac region, but passed from there to the right iliac fossa. The attack lasted for a week, and he then remained free from pain until the end of September of the same year, when there was a second attack, lasting about the same time. In neither attack was

there any vomiting. On December 14, a third attack commenced, and on December 16 he was admitted to hospital.

"On admission, his temperature was 100° and his pulse 124. He complained of tenderness in the right iliac fossa. There had been no vomiting.

"At operation, the appendix was two inches long and was apparently healthy, with the exception of some membranous adhesions which bound it to the outer side of the cecum. The cecum itself was extremely movable, and covered with a typical Jackson's membrane. There was a well-marked Lane's kink. The appendix was removed, and the membrane on the under surface of the mesentery binding down the ileum divided. The wound was closed without drainage.

"The next day the temperature had fallen to normal, and he made an uninterrupted recovery. He remained perfectly well for a month, but after this time had one or two mild attacks of pain similar to the previous attacks. These were in part relieved by the administration of liquid paraffin."

There is an interesting feature of Walton's work in this connection: of the 13 acute appendicitis cases of this type, 11 were females, while it is a matter of record that there are probably more males than females affected with true appendicitis. In these acute cases, Jackson's membrane was always present and was divided.

Of chronic cases of appendicitis, there were 16. Operative findings were same as those diagnosed for acute appendicitis—freely movable cecum having a definite mesentery in its greater part, very distinctive Jackson's membrane, but the fibrous accessory membrane on the under surface of the mesentery close to the terminal ileum was very frequent, being present to a marked degree in 6 of 16 cases. Mobility of the kidney was easily apparent through the incision. Operative procedures consisted in removing the appendix, division of Lane's kink, suturing, and division of portions of the Jackson's membrane, which appeared to give rise to kinking of the cecum. Of the 16 cases, 5 were apparently cured, 3 have been lost sight of, and 8 have shown only slight improvement. He gives the following case as illustrative of the symptomatology:

"W. S., female, age thirty-three, married, one child, age six. Since the age of eight years has suffered from many attacks of abdominal pain which used to double her up, and which she was told were due to colic. Eight years ago there was a severe attack of pain which was localized to the right iliac fossa. There was no vomiting, but much diarrhea. For this she was kept in bed two weeks. Afterwards there were frequent small attacks which kept her in bed for one or two days. Three years ago there was a second severe attack which persisted for one month, during which there was much vomiting and dysuria. In May, 1914, there was a third attack which lasted for two weeks. Between the attacks there was often slight indigestion. For four years, she has worn a ring pessary.

"On examination, September 22, 1914, she was found to be thin and poorly developed, with a flabby abdomen, showing some separation of the recti and a narrow subcostal angle. There was deep tenderness in the appendix area and definite splashing over the stomach and cecum. The right kidney was easily palpable.

"At operation, the appendix was found free. The cecum showed a long mesentery and was dilated. There was a well-marked Jackson's membrane, and the right kidney was abnormally mobile. The appendix was removed, and the Jackson's membrane ligatured and divided. She remained quite well for three months after operation, when she had another attack associated with vomiting. An abdominal belt, and liquid paraffin were ordered. On March 25, 1915, she stated that she was quite free from all symptoms when wearing the belt; but if this was omitted the pain tended to recur."

He reported 27 cases which had been diagnosed gastric ulcer. Of the 27, 5 had gastric ulcer combined with visceroptosis, 22 showed visceroptosis alone. Of the 5 cases showing the presence of gastric or duodenal ulcer, 4 were males, 1 female. The average is forty years of age. In addition to the ulcer, they all showed clearly one or more of the pathological lesions characteristic of visceroptosis. Thus, in every case there was a large movable cecum with Jackson's membrane and in others a Lane's kink was present. In all of his cases of gastric or duodenal ulcer, the cecum and appendix were invariably examined. In the same period in which 27 were operated upon, he operated upon 83 cases of pure gastric ulcers and in only 4 of these was there a definite kink of the terminal ileum. In the same period he operated on 38 cases of duodenal ulcer and only 1 showed presence of kink. These figures, he said, seem to show that the combination is a rare coincidence; that it is far more frequent to find an ulcer without visceroptosis than with it. In contrast to the sex involved in the true ulcer cases, which showed 4 males and 2 females, of the 22 cases of supposed ulcers and which proved to be ptosis, there were 18 females and 4 males. The average age was thirty-six, the oldest being fifty-eight and the youngest twenty-five. The symptoms had, as a rule, extended over many years, most commonly five or six, but occasionally as many as twenty. At the operation, there was no trace of ulcer found in the stomach or duodenum. The stomach was prolapsed into the U shape. All cases showed well-marked Jackson's membrane. Kidney was usually movable. Lane's kink was commonly present. Operative procedure consisted in dividing excessive bands and adhesions and if the appendix was bound down by the Jackson's membrane, it was removed.

The results of operative treatment could not be considered satisfactory. Nearly all cases showed marked relief for from two to six months, but after that time symptoms gradually returned. In one case, the patient stated two years later that she felt very well and was much better than

before operation, and this, in spite of the fact that the abdomen had been closed when the true nature of the condition had been discovered, without any operative measures having been taken. On cross examination, she confessed to one or two small attacks, the last of which had occurred six months previous. In other cases of like character, a certain amount of relief had been afforded by the use of the belt. We cite an illustrative case.

"E. S., female, age thirty-three. For ten years has suffered from slight attacks of indigestion. For the last five they have been severe and almost constant, so that she would only be free from the trouble for one or two days occasionally. During this time the pain was situated in the epigastrium, and was present for the greater part of the day. It was always increased by taking food, being most marked one hour after the meal. One year ago she had a more severe attack, during which she vomited two or three times a day. Vomiting caused a certain amount of relief, but never caused the pain to disappear entirely. She was admitted to a cottage hospital with a diagnosis of gastric ulcer, and was very strictly dieted and medically treated. This attack lasted two months, and under the medical treatment gradually improved. Six months ago the severe symptoms again returned, and continued until her admission to hospital on April 27, 1914.

"On examination, it was found that there was local tenderness over the right rectus, and a certain amount of gurgling in the area of the cecum, but neither kidney could be felt. The test meal showed free hydrochloric acid, 0.06 per cent, and a total acidity of 41.

"On April 29, the abdomen was opened by an upper right rectus incision, the muscle being displaced outwards. The stomach was found to be dilated and prolapsed, reaching well below the umbilicus. Its walls showed areas of local spasm. The duodenum was movable, and there were adhesions between it and the liver. There was no evidence of ulceration of the stomach or duodenum or of the presence of gall-stones. The cecum was long and lax, and was easily pulled out through the wound in the upper abdomen. There was a well-marked Jackson's membrane on its surface. The appendix was normal. The terminal portion of the ileum was firmly bound down by a stout accessory membrane on the under surface of the mesentery (Lane's kink). The accessory membranes were divided and the abdomen was closed. The patient remained perfectly well and free from all symptoms until October, 1914. For the next four months she had attacks of pain lasting for about one week, remaining free for intervals of three or four days between each. During the attacks there was pain—increased by taking food—and vomiting, which somewhat relieved the pain. An abdominal belt was ordered. She was last seen on May 20, 1915. She then stated that she had a certain amount of relief from the belt; but the pain had returned together with vomiting, and had persisted for the last six weeks."

Walton reported 6 cases resembling gall-stones. General symptoms were indigestion and flatulence, or windy spasms, of the same type as the symptoms now recognized as so characteristic of gall-stones situated within the gall-bladder. As in the case of true gall-stones, it was found on further investigation that these symptoms consisted of slight discomfort and fullness in the epigastrium and right hypochondrium coming on immediately after food or even before the meal was finished. As a rule these symptoms would occur every day without intermission, although in one case they were only present during severe attacks. Flatulence was a very marked feature. Eructation of gas would be followed by considerable relief. On examination the patient showed the usual ptotic shape of the abdomen. At operation the same pathological condition was found as described in previous groups. There was the same visceroptosis, presence of bands and membranes and the evidence of local spasm in the stomach wall. In two of the cases, the kidney was found to be so movable that it was considered wise to fix it through an incision in the loin. Apart from this, the operative procedure consisted of division of the adventitious bands and adhesions and, if necessary, removal of the appendix. Later an abdominal belt was ordered.

It is an interesting observation of Walton that the best results in these cases were when the kidney was fixed. This undoubtedly was due to the holding up of the colon by the fixed kidney. The simple removal of the appendix and division of membranes gave only temporary relief. The following is an illustrative case:

"M. K., female, age forty-eight. For twenty years the patient had suffered from fullness and discomfort immediately after meals. These symptoms were associated with flatulence, the eructation of gas being followed by some relief. During the last two or three years she had had, in addition to the constant discomfort, several attacks of very severe pain, which would come on at any time irrespective of all food, and not infrequently would wake her at night. At these times the pain, which was situated in the right hypochondrium and passed to the back, was so severe that she had to walk about. It would be associated with retching but there was no vomiting. Several times she had been distinctly jaundiced afterwards. There had never been any hematemesis. Occasionally the stools had been dark, suggesting melena. She was admitted to the hospital on November 19, 1914. On examination, there was tenderness in the right hypochondrium, but the gall-bladder could not be felt. The kidney was distinctly movable and there was a dilated cecum. The abdomen was narrow and the abdominal wall poorly developed.

"An operation was performed two days after admission, the abdomen being opened by an upper right rectus incision. The gall-bladder was found distended with bile, but it was easily emptied, and no gall-stones were present. There was marked general visceroptosis, the stomach being prolapsed and somewhat dilated. The cecum was freely movable

so that it was easily withdrawn through the incision in the upper abdomen, and there was on the outer side a well-defined Jackson's membrane. The kidney could be felt freely movable. The abdominal wound was closed, and the kidney fixed through a separate incision in the loin. Convalescence was uneventful, and, excepting for slight flatulence and discomfort after meals, she has remained well until now—six months after operation—the greater part of the symptoms in her case being due to the mobile kidney.”

In 5 cases the patient's abdomen was opened with the expectation of finding carcinoma of the stomach. In this case the sex relation differs in that four were males and one female. The following illustrative case shows the general findings:

“C. A., male, age forty-eight. Until seven months before admission, he had enjoyed perfect health. Since that period he had had constant indefinite pain and discomfort in the epigastrium and right hypochondrium. At no time had it been severe, but it showed a tendency to increase. There was no definite relationship to meals, food sometimes increasing and sometimes relieving the pain. With the discomfort there was much flatulence and regurgitation of bitter fluid. Vomiting was slight, but when present did not relieve the pain. On one occasion there was a slight hematemesis, but several times he passed dark stools, the color of which his doctor thought might be due to the presence of blood. Ever since the onset of his symptoms, his appetite deteriorated, so that on his admission to hospital on March 30, 1914, he felt no desire for food. During the same periods he lost twenty-one pounds in weight.

“On examination, he was somewhat wasted. There was tenderness over the right upper rectus, but nothing could be felt in this area. Knee jerks were present. A test meal showed the absence of free hydrochloric acid and a total acidity of 41. The abdomen was opened by an upper right rectus incision, the muscle being displaced outwards. The stomach was found to be prolapsed and dilated, the walls readily passing into local spasm. There were membranelike adhesions between the ascending and the transverse colon. The cecum was movable and showed a well-developed Jackson's membrane. The terminal ileum was bound down by an accessory fibrous band on the under surface of the mesentery. The appendix passed behind the cecum, and was partly covered by the Jackson's membrane. The bands and adhesions were divided, the appendix removed and the abdomen closed.

“He made an uninterrupted convalescence, and showed a certain amount of relief from the operation. He still continues, however, to have some discomfort after food, although his appetite has somewhat increased. Occasionally there is slight vomiting.”

These cases of Walton form a very important clinical link in the development of the conception of the ptosis question. In all of this group

of cases which he has operated upon for what he supposed was an organic right-sided lesion, he found the same thing—a mobile cecum with membranes and bands. The results were the same in all the different symptomatic groups in that the majority were temporarily relieved by cutting bands, followed by recurrence of symptoms. Some relief was later brought about by the use of a belt in support of the abdominal organs.

I have seen nothing in literature which more clearly proves that the membranes and bands are conservative developments for the purpose of holding up an otherwise mobile colon. To show that the band or membrane is not the real pathology, nothing is necessary except to call attention to the fact that after the band has been cut, as in all this group of cases, the symptoms return no matter whether they are manifested in the stomach, gall-bladder, duodenum, appendix or kidney.

Waugh's paper deals with a group of 180 cases in which the colon was fixed. In addition to the 180 adult cases, Waugh has fixed the ascending colon in more than 100 children under twelve years of age.

He divides his cases into five types, with regard to character and localization of the pain and says:

“But they manifest clinical signs and symptoms which are common to all of them at first, and subsequently become obscured by the appearance of the type pain which in the estimation of the patient relegates his other symptoms to the background. The onset is generally dated by the patients from the age of twenty years or thereabouts, and described by them as the appearance of “indigestion.” This is no more than a feeling of fullness and discomfort after meals, flatulence, and some lethargy. This indigestion cannot be explained either by indiscretions of diet, bad habits of life, or unsuitable environment, and it is not amenable to any change from one of the supposed causes. The average duration of these symptoms is about six months, and then pain in one or the other region of the abdomen appears for the first time.

“During these six months many remedies for ‘indigestion’ have generally been tried without effect, and, with the appearance of pain, the patient is no longer content to regard the trouble as being of a trivial nature. Particular emphasis must be laid upon one aspect of ‘pain’ in these cases: Although it is constant in type and constant in location for the individual case, it is characteristically erratic and irregular in its times of appearance, both with reference to the number of days on which it may be present, followed by lucid intervals of entirely irregular duration, and to its appearance, disappearance, and reappearance sometimes in the course of a single day. This erratic chronology of the pain is so essential a feature of these cases that it assumes the position of a sign of much diagnostic importance. Granted that the pain has an organic origin, then the factor that produces it must clearly be one that is erratic and variable in its action.

“Now the load of the mobile ascending colon, and consequently the

strain that it exerts, are most certainly variable. Herein appears to lie the explanation of what is such a marked feature of these cases, namely, the constant inconstancy of the pain. Perhaps, too, this inconstancy affords an explanation of the diagnosis that had already been presented to so many of the patients that they were 'neurotics' or 'neurasthenics.'

"Added to the presence of pain, loss of weight has now become a noticeable feature, and profound lassitude has become a disquieting and daily experience. Many of the patients in this series record a loss of from 14 pounds to 28 pounds during the first year of their illness. In the later stages general wasting and tissue degeneration all over the body is one of the grossest features of the condition.

"With the exception of 31 cases out of the total series of 180, constipation had never preceded their symptoms; these 31 had been constipated since childhood, and in those who subsequently became so, constipation did not appear as a rule until after an average of four years' suffering. Constipation in these cases is the result of the final breaking down of the colon in performing its natural function under mechanical conditions badly suited to it, and cannot be regarded as the cause of symptoms antecedent to it by about four years.

"Pregnancy, as might be expected, affords great relief to these patients when the broad plateau of the gravid uterus supports the prolapsed colon. The symptoms generally disappear so completely that the patients are convinced of the soundness of the advice that 'if only they could have a baby they would get well'; their disappointment is bitter at the reappearance of their old symptoms when the baby is about two months old and their return to active life without the support of a gravid uterus has once more exposed their ascending colon to the unrestricted action of the force of gravity.

"On examination of the abdomen, the fullness of the cecum and ascending colon is easily ascertainable, and, in 79 per cent of the cases, the right kidney shows variation of position between a gross prolapse and slightly increased mobility and palpability. This is a clinical sign that must be regarded as of more importance in considering the diagnosis of disorders of the alimentary tract than of the urinary tract, when taken in conjunction with the observation that, although a mobile kidney was present in so large a proportion of the patients, no symptoms were present that could possibly be attributed to it. A few of the patients had renal crises in addition to their other symptoms, and these were relieved by operation upon the colon without any surgical procedure being performed on the kidney."

TYPES OF CASES

"These are recognized only when pain has made its appearance.

"Gastric Type.—Pain is experienced in the stomach area somewhere along the left costal margin and ensiform process of the sternum. It

comes on very soon after food, within ten minutes to three quarters of an hour after a meal has been taken. But it does not come on after every meal, and it does not necessarily appear every day; sometimes it may come on just before a meal, and though as a rule the taking of food then makes it worse, it sometimes makes it better. It is generally described as being 'nagging' or 'boring' in character, and may radiate through to the back. Localized tenderness can often be detected by the patient over the point of maximum intensity. Thus the location and character of the pain are constant for each patient of this type, but the times and seasons of its appearance are variable. It does not necessarily appear after every meal in any given day, nor does it appear every day in an unbroken sequence. Sometimes there may be an interval of a few weeks between the attacks of pain, sometimes a few days, sometimes only a few hours; sometimes there may be many weeks of pain with only a brief lucid interval of a few hours' duration. It is unaffected by the quality of the food taken. Most of the patients of this series, after several years of dieting under skilled advice, had thrown all restrictions away, and unhesitatingly affirmed that they had derived no benefit from model dietaries, and were no worse when they ate what they liked.

"Several of the patients had been regarded as the victims of gastric ulcer, a diagnosis that is negatived by the erratic behavior of the pain. When an ulcer has once formed, pain is constant in its times of appearance; it always comes on after food, it is always made worse by food, and there are no lucid intervals. But when a pain is caused by a strain that is variable in its intensity, then it will make its appearance only when the strain is effective up to the point of producing pain, that effectiveness being determined by the load which the dropped colon is carrying. None of these patients with inconstant gastric pain have been found at laparotomy to have had structural disease of the stomach; and all of them have had a mobile ascending colon; whilst in the patients in whom ulcers were known to be present before operation (see details of ulcer cases), and a mobile ascending colon was always found at operation, the pain had been constant in its appearance immediately after taking food, and so severe as to make each meal an intolerable experience.

"This constant response to a stimulus is a characteristic of ulcers generally in other parts of the body, and the gastric ulcer appears to be no exception. Moreover these patients (that is, those with gastric ulcers) had obviously benefited from restrictions of diet for brief periods; the restrictions were often self-imposed, but since they had no direct healing action upon the original ulcer, the time had come for most of them when even the taking of Benger's food was an ordeal they hesitated to face. The inconstant gastric pain is not due to an ulcer, but to a variable strain produced by a variable load in the offending segment of gut.

"Nausea is sometimes present, but actual vomiting appears, from the histories of the patients, to be of very rare occurrence. So clear does the differentiation seem to be, by means of the histories, between the pain

from the strain on the stomach of a mobile colon and from a gastric ulcer, that occult blood has never been searched for, and this omission has not been penalized by the unexpected discovery of an ulcer at the subsequent laparotomy. All the cases of ulcer had had gross hematemesis or melena, or both. The need for the test appears to arise from an inadequate evaluation of the patient's symptoms, with the apprehension that a laparotomy may be performed and no ulcer be found. An operation should be performed with the certainty that no ulcer will be found and the high expectation that benefit will accrue from it.

"Duodenal Type.—Pain is experienced in the right hypochondrium, and is characteristically a 'hunger pain' that appears about three hours after food and is relieved by the further taking of food. But once again, whilst its character and location are constant, its times of appearance and response to the taking of food are constantly inconstant. It is not necessarily a daily experience, nor, because it appears before one meal in the day, does it always recur before each subsequent meal. As a rule pain is relieved by the taking of food, but sometimes it is not relieved, and sometimes it is made worse. When the strain of the mobile ascending colon falls with maximum intensity upon the second part of the duodenum—the site that is most liable to ulceration—taking of food can clearly have one of two effects upon the load in the ascending colon: Either the wave of peristalsis initiated by the next meal shifts the load into the transverse colon, and so relieves the strain upon the duodenum, or the meal merely silts up in the ascending colon, and adds to its load, thus failing to relieve, or even intensifying, the pain. As a rule the former happens, and so the phenomenon of a 'hunger pain'—that is, a pain relieved by food—is established. Alternatively the pain is made worse—a rarer event—in an easily explicable manner, when the food merely adds to the load of the ascending colon. Further, a new light appears to have been thrown upon the origin of 'hunger pains,' which it must be emphasized have been studied in all these patients in whom no duodenal ulcer could be detected at the subsequent operation, in entire accordance with one's expectations.

"The time of appearance of a 'hunger pain' coincides as a rule with the time when most of the previous meal will have arrived at the ascending colon—that is, within from three to four hours after feeding. When pain has been established, it may as a rule be relieved by inducing further peristalsis in the alimentary tract by taking food—a method of relief which sometimes quite significantly fails, as has already been explained. Hence the 'hunger pain' is really a 'food pain' determined by the arrival of food at a portion of the alimentary tract where it can exert a noxious strain, exhibiting a variability that would be expected from a variable strain, and responding in an erratic manner to a method of relief, that is not strictly controlled, for augmenting or diminishing the strain. The difficulty of explaining a 'hunger pain' by the presence of a duodenal ulcer—even if the inability to detect an ulcer in all these cases was

assumed to be a personal failure—is that a duodenal ulcer, in being soothed by active movement and arrival of foreign material in the duodenum—since the food must get out of the stomach some time—is made to exhibit characteristics which ulcers elsewhere do not display. On the contrary, in the few cases of actual duodenal ulcer in this series, the patients have been most emphatic in their statements that, after a preliminary period of many months and sometimes years of intermittent ‘hunger pains,’ their pain in the right hypochondrium has been constant for many months, and is always made worse by food. They can recognize very vividly for themselves the change between the pain that was an erratic visitor soothed by food, and one that has now become a constant companion from which no relief can be found.

“The knowledge of the association between ‘hunger pains’ and a duodenal lesion is a debt that surgery owes to Moynihan, and further elucidation of its details can be regarded only as an amplification of his pioneer work, and as a grateful recognition of the stimulus that he has provided to further endeavor.

“**Biliary Type.**—Several patients have given a history of attacks suggestive of gall-stones—some have received expectant treatment with the diagnosis already provided by their medical attendant; but only those cases are included under this heading in which the actual crisis has been witnessed by the writer. The crisis is very severe, and characteristic of obstruction to the outlet of the gall-bladder, either at the neck or at the cystic duct. The onset is sudden, and intense pain is experienced in the region of the gall-bladder, leading to vomiting and collapse. The upper segment of the right rectus is too rigid for any underlying structure to be recognized by palpation. The attack may last for from twelve to thirty-six hours, and when it has passed off, with relaxation of the rectus, a tender, swollen gall-bladder can easily be felt. This shrinks to normal size in a few days’ time. Jaundice, except for an occasional faint tinging of the conjunctiva, does not appear; the stools contain plenty of pigment, and bile does not appear in the urine. The attacks are nonfebrile as a rule, although in one case elevation of temperature occurred for forty-eight hours. At the subsequent laparotomy, performed generally within a fortnight after the crisis, a healthy gall-bladder without calculi was present in each patient, and a mobile ascending colon with its primitive mesentery. But an additional feature of great interest, and needing further investigation, was present in some of the cases. The gall-bladder was attached either to the second part of the duodenum, or to the hepatic flexure of the colon, by a band of membrane passing from these structures to the ventral surface of the gall-bladder and cystic duct over most of its length. This membrane is so constant in its attachment along a line to the ventral surface of the gall-bladder that it does not appear to be of inflammatory origin. It has well-defined lateral surfaces with small blood-vessels upon them, a free edge towards the fundus of the gall-bladder, and a broad base that fuses with the anterior layer of the gastro-

hepatic omentum. On cutting the membrane to free the gall-bladder, two edges with cellular tissue between them are left along the line of section. Such features are suggestive of a persistence of a small portion of the primitive anterior mesogastrium, between the layers of which the gall-bladder develops, rather than of adhesions of an inflammatory origin, which would in all probability show a more haphazard distribution. The point needs further investigation; but of whatever origin, it is clearly one medium whereby the strain from a sagging ascending colon can be transferred direct to the gall-bladder and cystic duct. The other medium is the gastrohepatic omentum, which, sagging under the weight of the colon, bends the cystic duct at an abrupt angle to the neck of the gall-bladder. If complete obstruction is caused through either of these means, then an acute biliary crisis follows. But it is conceivable that only partial obstruction may be caused in a number of cases, not sufficiently severe to produce a crisis, but sufficient to add the element of stagnation to the circulation of the bile in the gall-bladder, so that the arrival of attenuated bacteria results in the formation of gall-stones. A few patients in this series, with a mobile ascending colon but no symptoms suggestive of a lesion of the biliary apparatus, were found to have gall-stones also at the operation; in their case a silent formation of gall-stones had occurred without incidental complete blocking of the cystic duct either from within or from without. Since the gall-bladders of all human beings, and especially all typhoid patients, are subjected to the influence of bacteria arriving from the alimentary tract from childhood upwards, whilst gall-stones are not formed in all of them, it is possible that stagnation is the inconstant factor, which, in its turn, depends upon the inconstant survival of the mesentery of the ascending colon.

“Renal Type.”—In addition to their general symptoms of indigestion, these patients experience renal crises of great severity. Several have given a history that ‘they were suspected of having a stone in the kidney,’ but for only four included amongst this type are those in whom the crises were witnessed by the writer. They were so severe as to produce collapse and vomiting, whilst the right kidney was swollen and tender. (One patient had eleven crises while under observation.) When the attack is over, the kidney rapidly shrinks in size, but there is no increased output of urine, and the normal quantity that is subsequently passed is found under the microscope to contain a few red blood corpuscles. Apparently a partial occlusion of the renal vein is brought about by the drag of the colon during the attack; and it is of interest to note that, in the case of multiple crises, the attack could be cut short by the administration of a high glycerine enema, accompanied by a hypodermic injection of pituitrin. The usual routine examination for a renal or uterine calculus was made beforehand in all these patients, with negative results; their urine was normal in composition in the intervals of their attacks; and at the subsequent laparotomy it was not possible to detect anything

wrong with the kidney or ureter in any of them. All of them had a mobile ascending colon.

“Right Iliac Fossa Type.”—In these cases chronic pain in the right iliac fossa is the salient feature, added to the usual dyspeptic symptoms. It is not focal, and has not the severity of the type pains. It may remain present for several days, and is often described as a severe discomfort experienced diffusely over the right iliac fossa. In some patients it is present in addition to the type pains, and is then considered a trivial disability in contrast with the type pain. It appears to be a sensation experienced from a chronically overdistended segment of gut, to which the element of dragging is added. Several of these patients also give histories of attacks of mucous colitis; but in one patient the operation on the colon was deliberately undertaken for the relief of persistent colitis of seven years’ duration.

“In the other patients, in whom colitis was not continuous as in this one, but appeared as occasional attacks of about three weeks’ duration, there has been no recurrence of the attacks following the operation on the colon. On the other hand, it must be noted in connection with this difficult disorder that in one patient, not included in this series, who had been suffering for a year from a very grave bloody colitis, the ascending colon was not fixed at the operation deliberately undertaken for that purpose; and the patient made a complete recovery after the removal of the appendix and the fixation of the omentum to the abdominal wall to straighten out the hepatic flexure (Coffey’s hammock operation).

“Children.”—The condition is generally regarded either as ‘chronic appendicitis’ or merely as ‘dyspepsia’ in children. Pain, not very severe, which often lasts for several days, is complained of in the region of the right iliac fossa. It is intermittent in character, and examination of the abdomen seldom reveals any obvious explanation of its presence. There is no real tenderness, no muscular rigidity, but a full ascending colon can be detected when carefully sought for. Vomiting seldom occurs, but nausea and lack of appetite are invariably present. There is often high fever, with a quickened pulse-rate, and an abundance of acetone in the urine. The patient is clearly very ill, and the absence of guiding signs, in the region where the symptoms are experienced, is a source of anxiety that may lead to a panic removal of a healthy appendix. In the absence of tenderness, rigidity, and mass formation, no anxiety need be felt on this score; whilst the palpation of the outline of the overdistended ascending colon is sufficient to enable a diagnosis to be made. This can be subsequently confirmed, when the attack is over, by an X-ray examination. The illness often passes off with a slight attack of diarrhea. The persistence of a mesentery to the ascending colon has been confirmed at subsequent operation in more than 100 children under twelve years of age, in whom, rather as a diagnosis of despair than a profound mental conviction on the part of their medical advisers, who had witnessed several attacks in each of them, appendicular mischief was said to

be present. In 7 of them, disease of the appendix was also found at the operation, but in the remainder the appendix appeared to be healthy in every respect. These operations in children have not been included in the total series of 180 cases which are under review in this article. It has not been possible, under war conditions, to follow them up with sufficient precision to justify at present any exact conclusions. Several of them have been seen incidentally at long periods after the operation, and their condition was most satisfactory, but many mothers showed a reluctance to continue bringing their children to hospital merely for the purpose of inspection when they were apparently well."

The two clinical pictures given in Walton's clinical report and Waugh's general clinical summary are so similar to each other in general effect and so in accord with my own observations on right-sided ptosis that it would be supererogation for me to make any further statement but for the fact that I have an unusual case combined with an accurate record of pathological findings to relate, which shows a complete clinical picture of combined right-sided and midline ptosis.

The patient was a young lady, just approaching eighteen years of age.

Family History.—Her paternal grandmother had suffered a great deal with abdominal pain and was always a semi-invalid. Her father, president of a large teachers' college, is of very thin ptotic build and has always had a good deal of distress in his abdomen, particularly in the right side. On April 18, 1917, her sister, who was then twenty-two years of age, was operated upon by me on the pre-operative diagnosis: "Profound intestinal stasis with block at the hepatic flexure," evidenced by the fact that the patient rarely had a bowel movement oftener than once in two weeks. The findings were "extreme (almost complete) blocking at the hepatic flexure by adhesions binding together loops of intestine. Cecum enormously dilated and several inches longer than normal." (This patient had been operated on elsewhere when she was fifteen for chronic appendicitis with no relief; was constantly sick until twenty-one, when she was operated upon again for adhesions. At this operation ptosis was discovered and some kind of an operation performed.)

Personal History.—Very well as a child. Two and a half years ago (March, 1920), was going to school when she had a severe pain in her right side, lasting four days. It was located low down in the iliac region below McBurney's point. The pain was severe for four days and the region was sore for two weeks. June 6, 1920, took a trip to California. On the way, she was seized with another severe attack similar to the first. At this time her lower right abdomen was sore for three months when she began to take on fat as a result of her prolonged rest. With the deposit of fat, the pain and soreness ceased, and she went back to her school. Began to lose flesh again. In January, 1921, she had another attack followed by soreness lasting several weeks. In July she had another mild attack, soreness again lasting several weeks. Upon pro-

longed rest, the patient again gained flesh. In December, 1921, she began to lose weight and a constant pain and soreness developed which was continuous. During the winter of 1921-1922, she had pain in the abdomen. The pain was tearing in character. From that time on she had soreness all the time. Left school in April, 1922. All the time she had soreness and a sensation of fullness in her right side. Her physician at that time urged her to be operated on for appendicitis but she declined. She never had fever at any time and was never constipated. In May, 1922, with prolonged rest, she put on a certain amount of weight, after which she gained in health, but the soreness in her right side never disappeared. Lifting or dancing produced pain with the sensation of tearing or pulling. During her more severe exacerbations she had nausea and vomiting.

In the course of the history-taking, the patient volunteered the statement that the most striking thing in her case was that, when fat, she was much relieved. On loss of flesh she became much worse. When she entered the hospital, August 14, 1922, she had been practically a bed invalid for several weeks and, as she was constantly suffering, it was thought unnecessary to complete the usual preliminaries of a thorough X-ray examination.

Pre-operative Diagnosis.—The diagnosis before operation was so-called "chronic appendicitis," but is probably "right-sided ptosis with painful bands."

Operative Findings.—Long right rectus incision. Uterus small, otherwise pelvic organs normal. All the lower portion of the ascending colon and cecum completely mobile. A strong membrane, split in places into white fibrous bands but showing evidence of activity, extended diagonally downwards from the parietal peritoneum to just below the middle of the ascending colon, where it attached itself and acted as a ligament. Appendix was more than eight inches long and was attached by firm adhesion about one inch from its tip to the posterior or parietal peritoneum well up under the liver. From the point of its attachment to its tip, the appendix was dilated and showed some evidence of disease. (It will be noted that this distended portion of the appendix was eight inches away from the painful area.) From this attachment of the appendix to the posterior parietal peritoneum down to its origin, at the end of the cecum, the appendix was eight inches long, was strong and fibrous, and was acting as the chief ligament of the cecum, but was not diseased. There was a marked midline gastropsis with extra fixation of the duodenum by an acquired membrane. The hepatic flexure of the colon was very firmly fixed by extra acquired bands. A strong white fibrous band attached the omentum near the colon to the tip and under surface of the gall-bladder.

On lifting the transverse colon and omentum, an acquired membrane was seen extending from the root of the transverse mesocolon to the under surface of the colon and omentum. On cutting these membranes, a marked dilatation of the duodenum was observed below the colon. A groove in the posterior abdominal wall marked the location of the superior mesenteric

vessels crossing the last portion of the duodenum. Beyond this crossing, the jejunum was collapsed. Accompanying the vessels were definite white lines of secondary development which had apparently been laid down in accordance with Lane's law to help sustain the intestines below.

This is one of the most perfect and complete pictures of early ptosis due to mobile cecum that we have seen. Figs. 124 and 125 faithfully set forth

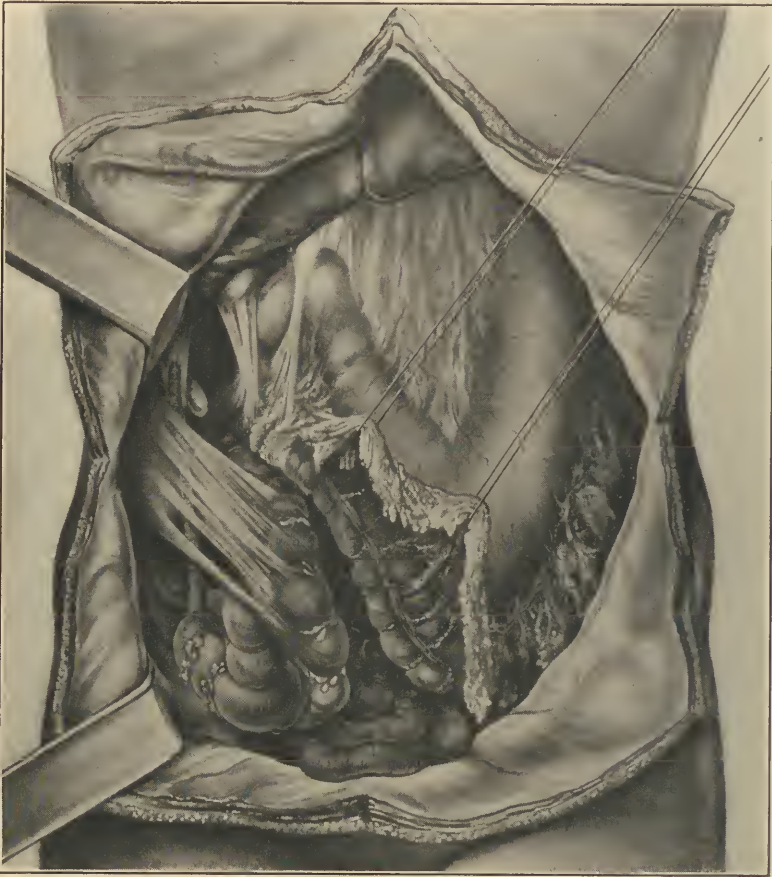


FIG. 124.—MIDLINE PTOSIS, RIGHT-SIDED PTOSIS, MOBILE COLON HELD BY FIRM BANDS FROM THE MIDDLE OF THE TRANSVERSE COLON BY THE APPENDIX FROM ITS TIP.

Transverse colon supported by extra bands, one crossing the duodenum, the other going to the under surface of the gall-bladder. Omentum held up to show the relation of the intestines.

the condition as it existed. The membranes, as will be observed, were entirely independent of the appendix. The pain of which she complained for two and a half years, located low down in the right side of the abdomen, had no connection with the only part of the appendix which showed the slightest disease. The attachment of the membranes to the ascending colon and the dilatation of the cecum corresponded accurately to the site of the pain. This development had taken place at a period beginning with the

sixteenth year and had reached this complete development by the end of the eighteenth year of age.

The chain of pathology that may develop as a result of right-sided ptosis, or nonfixation of the right colon as shown by this case, follows:

1. Nonfixation of the cecum and ascending colon.
2. High fixation of the appendix and its mesentery well up under the liver.



FIG. 125.—THE TRANSVERSE COLON TURNED UPWARDS.

The same picture of the ascending colon and appendix as shown in Fig. 124. Additional membranes develop from the root of the mesentery to help further in holding the transverse colon. The short portion of membrane to the left continues across the transverse colon forming bands going to the liver and duodenum, shown in Fig. 124. A groove shows the superior mesenteric artery with evidences of lines of crystallization producing dilated duodenum, duodenal arteriomesenteric ileus.

3. Fixation of the hepatic flexure to the front surface of the kidney with acquired membranous development to strengthen the supports.
4. Acquired membranes extending from the parietal peritoneum across to the mobile colon.

5. Acquired membranes along the under surface of the first part of the transverse mesocolon, for the extra support of this part of the colon.
6. One band extending along the omentum from the colon to the under surface of the gall-bladder.
7. Another extending from the colon across the duodenum, making extra fixation.
8. A midline ptosis probably due to dilatation of the stomach, secondary to dilatation of the duodenum, which was produced by duodenal arteriomesenteric ileus.

All the above features showed just as clearly as these pictures indicate, and when taken with the history of the case, make a complete clinical and pathological picture of right-sided ptosis.

Diagnosis and Indications for Treatment.—The most important manifestation indicating surgical treatment for right-sided ptosis is right-sided pain or distress. Right-sided pain or distress was formerly considered as positive evidence of organic disease. In the early nineties, the ovary was supposed to be the cause of much right-sided pain. Therefore, the right ovary or both ovaries were removed and the patient made a nervous invalid thereby, while she remained unrelieved. A few years later, chronic appendicitis became the vogue and many of these patients whose ovaries had been removed now had the appendix removed—without relief. Many of these patients had stomach troubles for which gastro-enterostomy was sometimes performed—again without relief. The gall-bladder was drained in many cases without relief, until removal of the gall-bladder came to the front—this also without relief. The enthusiastic and optimistic surgeon who had removed the patient's ovaries, later her appendix, done a gastro-enterostomy, fixed her right kidney, drained her gall-bladder and finally removed her gall-bladder, each time felt sure he was going to solve the problem even in the absence of demonstrable organic pathology, but the patient went on with pain and distress. Finally, after having failed to relieve her, he gravely pronounced her a "neurasthenic."

Many of the ablest surgeons of our time have taken the view that this pain, if real, must be due to an organic lesion. If not due to an organic lesion, it is because the patient is a hypersensitive neurasthenic. I am certain that great injustice has been done these suffering and maltreated individuals. We must draw a sharp line of demarcation between this class and the class of individuals who have pain, not only in the right side but in the left side; and in the shoulder; in the neck; in the back of the head, in any scar that may have been made by a surgical operation; from any demonstrable abnormality such as varicocele in the male, and painful coccyx in the female; from the result of suggestions of possible pathology, such as adhesions, etc. This latter type of patient is an entirely different individual, and may be termed a "psychasthenic." This state does not necessarily bear any relation to the ptosis question, although it is often found with it.

With our modern clinics and means of investigation, the differentiation of organic and inorganic disease can usually be made. For instance, the typical abdominal pain which comes on suddenly, with severe griping in the umbilical region with nausea and vomiting and fever, finally ending with soreness in the right side, and which disappears to reappear in a few months, is appendicitis, as a rule, and is, therefore, an organic lesion. The history of a typical gall-stone attack is almost unmistakable and the pain is clear-cut. All the acute conditions, such as perforating ulcer, pancreatitis, gall-stones, appendicitis, etc., are easily diagnosed. There is no excuse for a careful surgeon failing to determine an obstruction of the ureter, a stone in the kidney, a cystic ovary, etc.

After eliminating organic lesions, by established clinical methods, in a patient who has had a long-standing right-sided pain, which seriously interferes with the performance of normal duties of life or makes life miserable, and which right-sided pain is always fixed and localized at the same point or points in the abdomen, and which pain is unrelieved by competent medical treatment, an exploratory incision is justified, whether former operations have been done or not. Occasionally, such an exploratory operation will reveal an obscure organic lesion as the cause of the pain; but usually the lesion is nonorganic. It is, therefore, a serious mistake to remove an organ on mere suspicion and leave untreated a mobile, sloppy cecum or an ascending colon which is being held up in places by bands or membranes. It is a mistake to remove a normal blue gall-bladder for pain in its neighborhood, when we find a mobile colon dragging on the peritoneum back of the gall-bladder or on acquired bands attaching it to the gall-bladder. Supporting the colon by appropriate sutures gives better results and conserves a useful organ. Lane and others have recommended removal of the colon in some such cases. This is much more serious than the removal of the gall-bladder or appendix. While the removal of a chronically stretched-out chordlike appendix, commonly referred to as "obliterated appendix," does no particular harm, it is in my opinion a mistake to simply remove such an appendix and leave a large mobile cecum, with bands attached to its surface, without shortening its supports and placing it in proper position. I believe it is malpractice to simply remove an obviously healthy appendix and leave a movable cecum on which there is a red membranous development, without supporting the colon in its normal position by sutures.

The chief indication for surgery in the treatment of right-sided ptosis is a chronic, localized, right-sided, abdominal pain or distress, in which no organic lesion can be demonstrated by any of the known clinical methods, nor by an exploratory incision, provided that a definite defect in the normal fixation of the ascending colon exists along with one or more of the various pathological manifestations usually occurring as sequelæ to the defective fixation. These pathological manifestations may vary.

- (a) They may be limited entirely to a large dilated mobile cecum, which is accompanied by constipation and chronic pain or distress on the

right side, low down. Pain is due to distention by gas and stagnant fecal matter.

- (b) It may be painful right-sided floating kidney which is an indication of defective fixation of the ascending colon and which is accompanied often by the intraperitoneal development of membranes and bands.
- (c) It may be right-sided pain which is constant, and worse when the patient is on the feet and especially if the pain is reflected upward and backward toward the right kidney region.
- (d) It may be pain in the gall-bladder region, due to a drag on acquired membranes and fibrous structures extending upward from the peritoneal supports of the colon.

The case reports and discussions by the various authors, which have been recorded in the preceding pages of this chapter, furnish the reader with the clinical data on which these conclusions are based.

Surgical Treatment.—Inasmuch as the essential predisposing cause of right-sided ptosis is a defective fixation of the cecum and ascending colon, it naturally follows that the essential feature in the treatment of the ills resulting from this defect is the fixation of the mobile colon. Owing to the fact that secondary developments have sometimes changed the anatomy, it is usually necessary to do more than the simple fixation. For instance, in a widely dilated, much elongated cecum, it is often essential to both narrow and shorten it in order to get it back on the psoas shelf. While ordinarily the acquired membranes and bands are not interfered with during the course of an operation, at times they so distort the relations of the ascending colon and cecum that it becomes necessary to cut them. The prolapsing ascending colon has frequently pulled the first part of the transverse colon downward, making tension on its peritoneal supports and calling forth acquired bands which cross the duodenum and give stomach symptoms. At times the colon has pulled the kidney out of position, and the prolapse has been so extreme and the distortion so great that it has produced organic disturbance of the kidney. In certain of such cases, fixation of the kidney from behind is necessary. As far as I know, Longyear was the first to consider and rationally apply the fixation of the ascending colon along with fixation of the kidney by using what he termed the nephrocolic ligament (see Fig. 115, Chapter XI). Almost simultaneously, Klose and Wilms began to recognize the pathological importance of a mobile ascending colon and to do surgical fixation for its relief. Klose sutured the intestine to the parietal peritoneum, while Wilms split the parietal peritoneum and inserted the end of the cecum and ascending colon into the slit without firmly suturing it. Both reported good results. The work of Klose appealed to me more than did that of Wilms. I began, therefore, to suture the cecum and ascending colon with linen thread. Soon I observed that there was some defect at the point where my sutures ceased and the transverse colon began. Therefore, I almost immediately began to combine the fixation of the cecum and ascending colon

with support of the first part of the transverse colon by suturing first its mesentery, and then its omentum to the abdominal wall over to a point slightly beyond the midline. This gave much better results. I occasionally encountered a very large, baggy cecum with stagnant contents which I could not get into place without shortening it. Klemm and Blake had both recommended plication of the cecum. I found that in two instances linen sutures used for plication of the cecum had supplicated, giving no end of trouble. I began, therefore, to suture the cecum with continuous catgut which both shortened and narrowed the intestine. Postoperative observations, in one case, showed that this did not make a permanent plication. I, therefore, combined this continuous suture with frequent interrupted sutures. I have found that this makes a permanent plication. The central feature of the operation that I now do for right-sided ptosis has been termed "right indirect colopexy and omentocolopexy," which supports the colon over as far as or beyond the midline. In the majority of cases, it is not necessary to plicate the cecum. In certain cases, however, it is necessary. Cecal plication is done as follows: A straight needle carrying a No. 0 chromic catgut doubled is used for a continuous suture, beginning at the convergence of the two principal longitudinal bands near the end of the cecum. The continuous suture is passed by taking first a bight of one band, then from one to three or four bights of the peritoneal covering of the intestinal wall between the bands. Then a bight of the other longitudinal band is included (Fig. 126). This line of suture continues as far as the intestine is dilated and baggy, usually about six inches. This continuous suture is drawn taut for the purpose of shortening as well as narrowing the intestine. This would seem sufficient, but experience has proved that a continuous suture does not make enough pressure to cause absorption of the endothelial peritoneal surfaces to a sufficient extent to permit firm fusion of the fibrous layers of the peritoneum. Therefore, the continuous suture is supplemented by interrupted sutures of No. 0 chromic catgut, which pick up the peritoneum on one side of the crossing of a loop of the continuous suture, pass under the loop and pick up peritoneum on the other side. These sutures are tied tightly and, as will be seen, include the continuous suture in their loops (Fig. 127). Having performed the cecal plication, or having decided that it is not necessary, I then proceed to perform right indirect colopexy by shortening its supports and including the lateral parietal peritoneum as follows: The small intestines are packed away from the field of operation by moist gauze. The ileocecal junction is pulled upward and to the left by the hands of an assistant. A heavy chromic catgut (No. 2) suture picks up the true parietal peritoneum at the curved angle which is formed by the junction of the posterior and lateral abdominal wall. This suture is placed well above and external to the prominence of the psoas muscle. Successive bights of peritoneum are then taken up across the front of the psoas muscle and along the mesocecum to the end of the cecum. This makes a purse-string suture. At the discretion of the operator, this purse suture may be tied now, or left until similar successive sutures have been placed above. I prefer to tie this purse suture when it is placed, in order

to be sure of the relations that will be produced by its tying. Similar sutures are then placed every three fourths of an inch, for about six inches, toward the normal location of the hepatic flexure. In picking up the peritoneum at the intestinal end of the suture, it is desirable to limit the territory of the suture to the mesentery or, at most, the peritoneal covering of the colon at its mesenteric junction (Fig. 128). Often it is well to place several extra



FIG. 126.—CONTINUOUS FINE DOUBLE CHROMIC CATGUT SUTURING THE TWO LONGITUDINAL BANDS TOGETHER TO SHORTEN AND NARROW THE BOWEL.

sutures in order to make the fixation secure. After placing these purse-string sutures for this distance, it is desirable to gradually bring the colon forward, which is done as follows: The suture includes a bight of peritoneum and mesentery at its junction with the colon, crosses the space and picks up a bight of the lateral parietal peritoneum just above the last purse-string suture. The next similar suture picks up a bight of parietal peritoneum three fourths of an inch to the front and slightly above the other suture.

Four or five similar sutures bring the intestine in a graceful curve forwards to the anterior abdominal wall, when the sutures begin to pick up the edge of the omentum, which is penetrated just distal to the colon and is brought to the abdominal wall, thus combining omentocolopexy or the hammock operation with right indirect colopexy (Fig. 129). This hammock operation is extended toward the left, as high up as possible, over to the median line or two or three inches beyond the median line, depending on the extent of the pathology and the necessities of the case (Fig. 130).

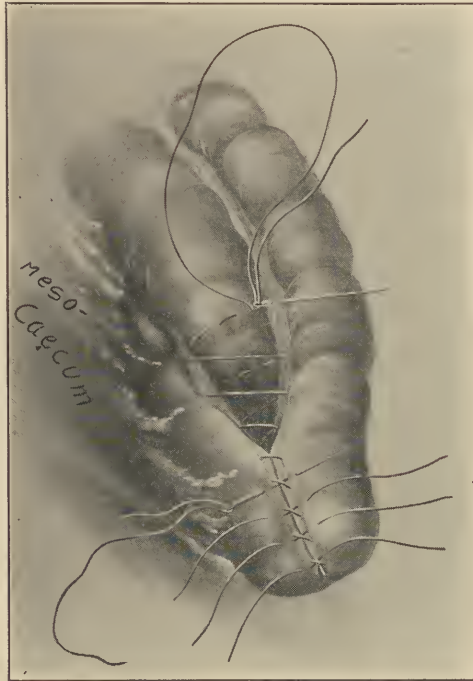


FIG. 127.—DIAGRAMMATIC PICTURE SHOWING METHOD OF INCLUDING EACH LOOP OF CONTINUOUS SUTURE IN THE GRASP OF AN INTERRUPTED CHROMIC CATGUT SUTURE.

This is necessary to produce fusion and permanent plication.

This is all that is ordinarily required for right-sided ptosis.

The typical case of ptosis, reported in detail on page 174 and illustrated in Figs. 124 and 125, combines a midline with right-sided ptosis, also with defective fusion of the descending colon on the left side which constitutes a potential left-sided ptosis. Therefore, in addition to cutting the membranes, removing the appendix, plicating the cecum, doing a right indirect colopexy and omentocolopexy on the right side, the omentocolopexy or hammock operation was extended all the way across to the costocolic ligament, making a complete partition in the abdomen (Fig. 119). Owing to the fact that this patient also had a duodenal ileus as a result of the drag, we placed three sutures above the colon and through the mesocolon between vessels, carrying out the suggestion of Pilcher. Patient made an uninterrupted oper-

ative recovery, took her food splendidly and soon gained thirty pounds or more and has been entirely well since, it now being more than six months since the operation was performed. The same indications for fixation of the kidney in certain extraordinary cases apply here as in general ptosis



FIG. 128.—PURSE-STRING PERITONEAL SUTURES FOR SHORTENING THE MESOCECUM AND FASTENING IT TO THE LATERAL PARIETAL PERITONEUM.
The end of continuous and last of plication sutures is seen at upper end.

referred to in Chapter XI. It goes without saying that the appendix in all these cases is removed. In three or four cases, the gall-bladder has been removed and a drain placed above the colopexy sutures.

The operation which we have described above as "indirect colopexy and

omentocolopexy" is the operation which we have most frequently used in our ptosis work—in about three fourths of the cases.

We have seen the results following this operation several times as we have



FIG. 129.—PURSE-STRING SUTURES TIED, OR BEING TIED.

The first suture directly fastens the colon and mesocolon to the lateral peritoneum partially tied, gradually bringing transverse colon around to the front wall. Last suture shows the beginning of omentocolopexy.

done subsequent operations for other pathology. In every instance, the omentum has been found solidly fused in an unbroken wall.

In one very tragic case, we had the opportunity to observe that this wall is water-tight. It happened as follows: A case of cardiospasm came for

treatment. She was very thin, had marked gastropotosis with gastric stasis. I had read Rovsing's suggestion that cardiospasm was probably due to ptosis and that the proper treatment was gastropexy. I therefore did a very complete hammock operation as described. The cardiospasm was not materially benefited by the operation, although the stomach was adequately supported, and so she returned a year later with the same symptoms. One



FIG. 130.—THE PURSE-STRING SUTURES FIXING THE ASCENDING COLON AND SUSPENDING FIRST HALF OF TRANSVERSE COLON TIED.

Sutures for fastening the omentum to peritoneum of abdominal wall two inches to the right of the medium line are placed. Additional sutures picking up the peritoneum of the colon and parietal peritoneum are placed to make fixation more secure. This we have termed "right indirect colopexy and omentocolopexy extending two inches to the left of median line." Usual operation for right-sided ptosis.

of my younger associates had seen the work of Plummer and therefore proposed to use Plummer's string and bougie. For some reason the string was not used and the bougie was passed with some difficulty. In doing so, the patient suffered a great deal of pain and was sent to the hospital. He had no thought of the seriousness of the accident so did not prevent the

use of water and food. The patient did not do well. Gradually the upper abdomen began to enlarge. At the end of a week, there was tremendous enlargement, stopping abruptly at a transverse line which would pass through the umbilicus. The tragic possibility then dawned upon us. The enlargement was opened under anesthesia and most of the water and food she had taken during the preceding days came out. The lower end of the esophagus had been ruptured by the bougie and the partition made by the hammock operation had proved itself efficient and water-tight, so that not a drop escaped into the lower peritoneal cavity.

I have stated above that this operation which I have described under the head of "right indirect colopexy and omentocolopexy" is an elaboration of the intraperitoneal colopexy of Klose. Waugh has elaborated the work of Wilms and it is probable that the operation which he has described in certain instances will be better than the one I have described above, but I believe that it should also be combined with the hammock operation. It is particularly applicable when the adhesions have been extensive and raw surfaces have been left where they have been cut on the outer side of the colon. I have included Waugh's operation on occasions with very great satisfaction. Waugh's technic⁹ is as follows:

"A sandbag is placed under the lower part of the thorax, as for gall-bladder operations, to render easier the access to the hepatic flexure. The lower two thirds of the right rectus is turned inwards, and the nerves are mobilized at the points where they pierce the sheath and the muscle respectively. As a rule it is then possible to preserve them intact, although the eleventh thoracic nerve is sometimes snapped by the displaced colon. The abdominal and pelvic contents are then carefully palpated and inspected, so that a view of most of the stomach, the duodenum, the biliary apparatus, the ileum and appendix, the ovaries and tubes, and finally the colon itself, is obtained. The region where the iliac colon passes over the left side of the pelvic brim is palpated to exclude any bands of thickening in its mesentery. The ascending colon, from cecum to hepatic flexure, is then lifted out on to the towels, and at this stage the main lines of strain upon the stomach, duodenum and gall-bladder can be demonstrated easily by gentle tugs upon the hepatic flexure. The mobility of the second part of the duodenum is tested by lifting it up between the finger and thumb, where, more particularly in cases of hunger pains, it can be brought up to the level of the incision in the skin. The appendix is removed if present, bands between the gall-bladder and colon divided, and rare bands, as those causing an ileal kink and those occasionally found at the brim of the pelvis on the left side, are similarly dealt with. The peritoneum and fascia are then incised just above the brim of the pelvis on the right side, and the incision is carried upwards parallel to the line of the colon and as close as possible to the root of its mesentery (Fig. 131). The upper limit of the incision corresponds approximately to the level where the colon crosses the duo-

⁹ *Brit. Journ. Surg.*, January, 1920.

denum. Here the fascia becomes much thinned, where it splits to inclose the right kidney. This curtain of peritoneum and fascia is then pulled outwards, and the bed formed by the iliopsoas and quadratus lumborum muscles freed of fat and cellular tissue until the muscle fibers and nerves of the



FIG. 131.—THE INCISION OF THE FASCIA. (Waugh.)

This incision covers the posterior abdominal wall and is shown by the dark line running from the level of the pelvic brim to the hepatic flexure close to the root of the primitive mesentery.

lumbar plexus are seen (Fig. 132). Into this bed the colon is then gently coaxed, the cecum being placed into position first of all. The curtain is pulled over it, and attached by interrupted stitches of catgut to the anterior longitudinal white band of the colon. This is a convenient landmark which

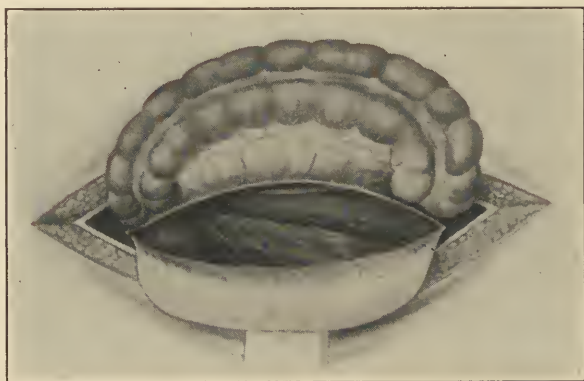


FIG. 132.—THE FLAP OF FASCIA RAISED AND TURNED OUTWARDS. (Waugh.)

The lower pole of the kidney is just seen at the upper end of the bed formed for the colon, the ureter can just be seen mesially, and branches of the lumbar plexus of nerves are visible emerging between the psoas and quadratus lumborum muscles.

insures the gut being held in proper position without torsion upon its own axis (Fig. 133). When gall-stones are also present—as they were in four cases of this series—they are removed in the usual way, and the gall-bladder drained after the fixation of the colon has been completed.

“‘Jackson’s membrane’ was only met with once in this series of cases. In cases of the ‘gastric type’ with a steep ascent of the transverse colon to

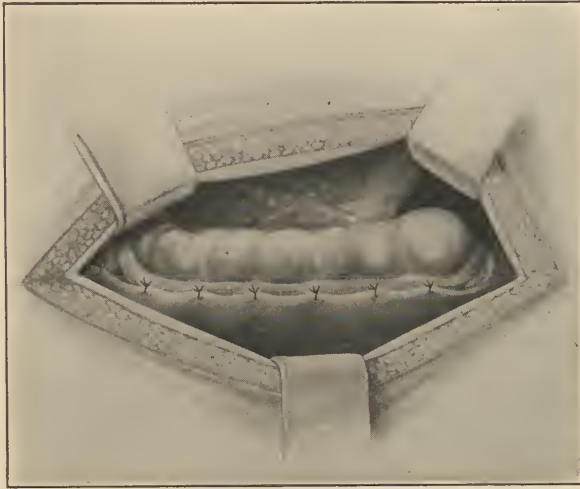


FIG. 133.—THE FLAP OF FASCIA HAS BEEN FIXED TO THE ANTERIOR WHITE LINE OF THE ASCENDING COLON, EXCEPT AT THE HEPATIC FLEXURE. (Waugh.)

At this point the topmost stitch has been fixed to the gut wall above the external to the white line.

the splenic flexure, the omentum is sometimes fixed transversely to the abdominal wall after Coffey’s method. The abdomen is then closed in the usual way.”

CHAPTER XIII

MIDLINE PTOSIS

Midline ptosis is an acquired visceral prolapse involving one or more of the organs which cross the midline of the abdomen, the prolapse thereby materially changing the relation of these organs to the normally fixed points of the intestine at the hepatic flexure, duodenum and splenic flexure and tending to produce relative obstruction or kinking at these points (Fig. 134).

The above title or designation has been adopted in preference to gastrop-tosis or gastrocoloptosis because of its wider significance. For it is not uncommon to find the liver down in these cases, which would not be included under either of these titles.

The first efforts at surgical treatment were directed towards gastrop-tosis, and the operations were performed independently, and apparently without the authors' knowledge of each other's work. The pioneer operations for this condition were done by Duret, Rovsing, Beyea, Bier, B. B. Davis, and the author of this monograph. Each of these writers, as he followed gastrop-tosis into the intricacies of enteroptosis, thought this was the primary condition and built his theory around it. This brought a great deal of ridicule from general surgeons, owing to the fact that they most frequently found gastrop-tosis as a part of a general process in which all of the organs were down, and the characteristic body formation previously described was shown. Even up to this time the majority of surgeons have failed to recognize the fact that gastrop-tosis and coloptosis producing symptoms may occur entirely independent of any other ptosis. In fact, those cases of gastrop-tosis and coloptosis producing most marked obstruction at the second portion of the duodenum or at the flexures of the colon are usually found in patients whose ascending and descending colon and their mesenteries have normally fused; a condition which makes a general ptosis practically impossible, as we have shown in another chapter. This point was recognized quite early, but the proof came only in 1911, when I made a critical review of the patients upon whom I had performed the hammock operation for gastrop-tosis and found that in only 4 of 41 cases were the kidneys movable. These were recognized as general ptosis and both kidneys were anchored. The hammock operation was done, expanding the upper abdomen. It is evident that Rovsing has dealt quite largely with this type of cases, which he first called gastrop-tosis and has more recently called gastrocoloptosis. While he has at certain points mentioned floating kidney and prolapsed ascending colon, he has apparently not recog-

nized the fundamental congenital background which makes possible these cases of general ptosis, and has limited his study to midline ptosis, or acquired ptosis.

He classes ptosis as virginal and maternal; he believes that the virginal type is produced entirely by the use of the corset, and that the maternal is due entirely to the bearing of children, by expanding the lower abdomen.

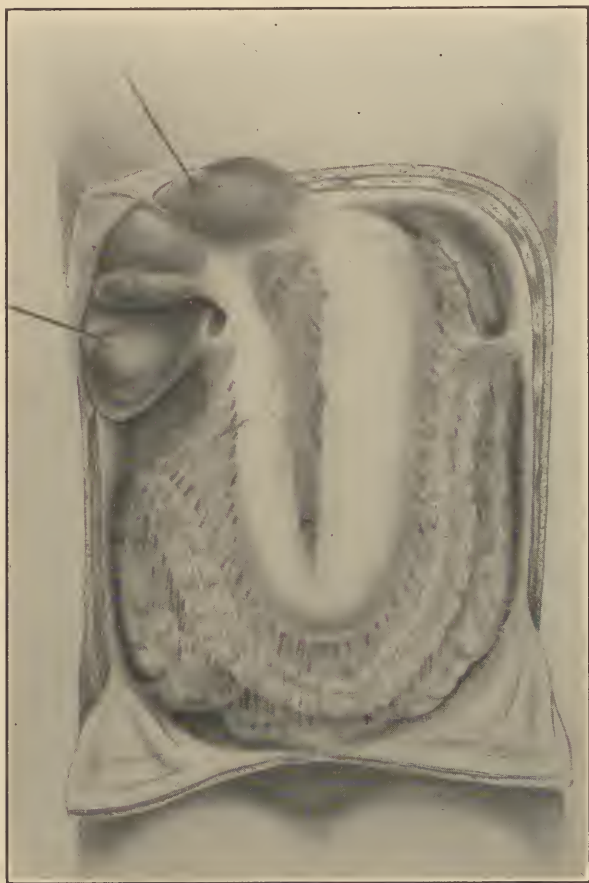


FIG. 134.—TYPICAL "MIDLINE PTOSIS."

Middle pyloric portion of the stomach and transverse colon prolapsed while the fixed points at the esophagus, duodenum, and colonic flexures, as well as the kidneys, remain in normal position. The pylorus is dilated so that the duodenum is continuous with the stomach

While I shall attempt later on in this chapter to prove that there are other very important factors entering into this subject, I take this opportunity to recognize Rovsing, who has limited his research to this particular type of ptosis and who, therefore, is entitled to a respectful hearing, as the pioneer in this work. I shall, therefore, with his consent, quote Rovsing's own words very largely in connection with this subject. His conception of the subject of gastrocoloptosis was published in *Annals of Surgery*, January, 1913.

"Confining the discussion, for the present, to gastrocoloptosis with women, I discriminate between two principal groups which, both as regards the pathogeny and the symptomatology, are rather sharply distinguished from each other; they are virginal ptosis and maternal ptosis.

"Virginal Gastrocoloptosis.—In the course of the first or second year after the commencement of puberty, when the wearing of corsets usually commences, the previously healthy individual begins to suffer from persistent constipation, to which are quickly added weariness, headache, and loathing of food. In addition to these symptoms there occurs, after some time, cardialgia, in the form of severe pains which are always situated to the left of the center line and occur as soon as the patient partakes of food. The quality of the food has no significance so far as the rise of these pains is concerned, whereas the quantity—the mass and weight of the food—is of great importance, for which reason these patients can only get along by taking many quite small meals during the twenty-four hours. In many instances the commencement of the pains is accompanied by vomiting, and with a smallish group of these patients each meal is invariably and immediately succeeded by the discharge of a part or the whole of the food partaken of. In the first instance, the patients may maintain an astonishingly healthy appearance for many years; but if they disgorge everything, and are furthermore frightened by fear of the pains from attempting to eat, emaciation sets in, which may often reach an extreme stage and present that aspect which I have called gastropptosis cachexia, and which may result in the death of the patient as a consequence of inanition.

"By examining the chemical function of the stomach, one generally finds that the measure of acidity is normal, but in a certain number of cases one finds achylia, and in others, conversely, hyperacidity and even gastrosuccor-rhea.

"In more than half of the cases, the motor of function is completely normal, inasmuch as the stomach empties itself entirely in the course of from four to five hours. In 30 to 40 per cent of the cases, there is a slight delay (five to seven hours), while food remains are rarely found eight hours after one of Bourget's experimental meals.

"With many of these patients, a whole series of nervous symptoms develop gradually as a result of this state of auto-intoxication and inanition, such as oppression across the loins, in the pelvis and the abdomen, clammy hands and feet, palpitation of the heart, physical depression; with some a mental relaxation and with others a sensation of dread. Finally disturbances in the function of the genital organs develop very rapidly, because the menstruation becomes irregular and is accompanied by diffuse pains in the abdomen and a deterioration of the regular symptoms. The menstruation is frequently very deficient, and for years many entirely fail to appear.

"The pathogenesis of this disease as shown by its symptoms is, in my opinion, as follows: the lacing up of the young girls' gracile, easily relaxing, and plastic body in corsets involves an increasing deformation and straitening of the lowest thorax aperture. This results in a shifting of the sub-

diaphragmatic organs. First of all, the pressure acts upon the massive liver, and this again by its great weight serves to dislocate the organs lying below. Paul Hertz has shown us in a very fine manner how nephroptosis arises from corset pressure, because this utilizes the liver as a lever to tilt the right kidney out of its niche, and we therefore understand why in the majority of cases the floating kidney is only on the right side. But to what still greater extent, and how much more invariably must the effect of the corset pressure on the liver extend to the stomach!

"It is clear that if the liver is pushed down the stomach must follow suit, and hereby the esophagus, the gastrophrenic ligament, and the cardial peritoneal covering *in toto* are stretched in a manner which corresponds with the extent of the subsidence. In this I perceive the cause of the invariable pains in the left side of the epigastrium, of which these patients always complain when they are up and doing, and especially during meals. But in addition, the posterior edge of the gastrohepatic and hepaticoduodenal ligaments must also become lengthened and dislocated. Together with the stomach, the transverse colon is pushed down, whereby more or less acute angled bends occur at the points of fixation at the hepatic flexure and the splenic flexure. This involves a hindrance of the passage of the feces from the colon ascendens to the colon transversum and, if they enter the latter, they will again be retained here for an abnormally long time, and then the hard, gnarled feces still further and continuously weigh down the transverse colon. Hence the ever-increasing constipation.

"I look for the cause of the virginal ptosis patients suffering so much more than the maternal ptosis patients do from pains and vomitings after meals to the circumstance that the tight abdominal wall and the narrow abdominal cavity do not permit of the free subsidence of the loosened organs. The result is that the stomach as well as the colon folds itself transversely with the longitudinal axis, and breaks and bends occur which hinder the natural passage of the food and produce stasis and pains. The fact of the matter is that all the vessels and nerves to the stomach from the large vessel and nerve roots have their course just between the peritoneal layers, which either form the suspensory ligaments or cover them. They form, so to say, an integral part of the suspensory ligaments and, when these are folded, are also subject to bends and folds; and, when the ligaments are stretched and lengthened by the subsidence of the stomach, a considerable drag is also exercised on the vessels and nerves. That such a distention of the sympathetic fibers and thereby of the ganglion celiacum and of nervi vagi, which, with the esophagus, extend into the thoracic cavity, cannot fail to affect the activity of these nerves, seems evident, and here, surely, is to be found the explanation of many of the nervous symptoms of these patients. As regards the invariable pains in the left side of the epigastrium, it seems to me that these are explained naturally as having their origin in the drag on the sensitive nerves which have their course in the subperitoneal tissues.

"In these conditions we have a simple explanation of the pains and disgorgements of the virginal ptosis patients immediately after partaking of

food; and, if these symptoms become invariable, the consequent results are emaciation and waste of fatty and other tissues in the abdominal organs, which makes room in the abdomen for a further subsidence of the subdiaphragmatic organs, and makes the suspensory ligaments of these thinner and more relaxable. But, by this, the subsidence of the colon is increased, and the constipation by degrees becomes more obstinate. With the resorption of the stagnant feces and a poisoning of the organism, arises auto-intoxication; but this is not all, because if the stagnation in the large intestine reacts on the function of the small intestine, the passage through the small intestine takes place more slowly, and, in certain cases, a real stasis may even occur in this. As assumed by Lane, this perhaps may be due to bends in the small intestine at its points of fixation (the duodenal kink and the iliac kink) where the subsided part of the intestine joins the fixed part; or, as Knud Lunn thinks, it may be only a result of the constipation, especially where valvulae bauhini are deficient.

"According to Lunn's observations, then, it seems as if the stasis is transmitted to the stomach, and we then get the delayed emptying of this, five to seven hours after the meal, which often occurs with gastropototic patients, and which is interpreted by certain authors as a 'primary atony,' and even by Stiller is considered as being the cause of the ptosis.

"The view of the matter is entirely beyond the point, because in more than half of the cases of gastropotosis the emptying is perfectly normal. The delayed emptying, on the contrary, which occurs with the minority of ptosis patients seems to me rather to be explained naturally by the difficult conditions of passage in the large and small intestines.

"The diagnosis of the virginal ptosis is generally not difficult for him who has once had his eyes opened to the peculiarities of the aspect of the disease, but for him who has not it offers many difficulties and stumbling blocks. Certain it is that few diseases are so frequently misinterpreted as this. The three wrong diagnoses under the flag of which virginal ptosis most frequently sails are (1) *ulcus ventriculi*, (2) *colitis*, and (3) *nervous disease of the stomach*, or *hysteria*.

"Those cases where violent *cardialgia* and vomiting occur as an immediate result of meals and dominate the aspect are naturally confounded with *ulcus ventriculi*. This confusion happens all the more easily because the violent and frequent vomitings by no means rarely show streaks of blood, or even such a strong admixture of blood that they assume the character of *hematemesis*. The presence of constipation, indeed, only strengthens the diagnosis, because it is so often a symptom with *ulcus*.

"In addition to this, the examination of the position of the stomach by scraping auscultation, or by roentgenoscopy after a bismuth meal, often reveals a subsidence which is inferior in proportion to the acute symptoms. With most cases, this seems to controvert the diagnosis, inasmuch as these cases mean quite plainly that the acuteness of the symptoms must be proportionate with the degree of the extent of the subsidence. Not until one has realized that it is just the circumscribed conditions of space which

hinder the pressed-down stomach from freely sinking down and, on the contrary, jam it between the tight abdominal wall, the spinal column and the other abdominal organs, and force it to place itself in bends and folds, does one understand that these very circumstances, in spite of the apparently minor ptosis, produce such acute symptoms.

"The differential diagnosis from ulcer is, as a rule, easily determined from the following facts: (1) The seat of the cardialgia is to the left of the center line. (2) The cardialgia does not depend on the quality of the food, but does on the quantity of this. An ulcer patient suffers pain from eating rich, sour, spiced food, no matter how small the quantity, but stands milk; while a ptotic patient stands all such food equally well so long as the quantities are quite small, but suffers severe pain from milk and other neutral food when the quantity is too large. (3) The position of the body influences the symptoms. These are always worse in an upright position, and always improve and often disappear entirely only with confinement to bed.

"The cases where constipation dominates the aspect of the disease, while the stomachic symptoms are comparatively minor, are often confounded with colitis. In many cases the confusion is promoted by this, that the constipation involves in reality a colitis with periodically occurring diarrhea. Here, also, it is a differential diagnostic symptom of great value; with ptosis, confinement to bed has a highly favorable effect on the constipation; while constipation arising from other causes generally becomes more marked with confinement to bed.

"The diagnosis hysteria and nervous disease of the stomach is generally given with such patients as have for a long time been vainly treated with ulcer therapy or anticonstipation treatment, partly because their having been vainly treated for a supposed organic disease leads to the diagnosis of functional neurosis, and partly because these patients, little by little, on account of their protracted sufferings and the fruitless treatment, become in a great degree psychically exhausted and nervous individuals. The differential diagnosis from hysteria is, however, by no means difficult, when one analyzes the history and the aspect of the disease; because it then always appears that constipation and dyspepsia have been the first symptoms and still constitute the central feature in the aspect of the disease. Scraping auscultation and roentgenoscopy show us the presence of ptosis, and, finally, an exact examination shows that really hysterical stigmata are practically always wanting.

"More rarely the pure ptosis is confused with cancer. This happens with those patients who have become completely emaciated by vomitings and abhorrence of food, lasting over many years, and who have acquired a cachectic complexion from the auto-intoxication arising from the stagnating contents of the large intestine.

"Complications and Consequent Diseases.—Some of my observations indicate that the traction on the esophagus of the subsided stomach may involve a difficulty with the swallowing and passing of the food, and thereby, also, changes in the esophagus itself. It is peculiar to a rather numerous group of patients with virginal ptosis that they either permanently

or periodically, especially when in an erect position, disgorge the food immediately after swallowing it. In other instances I have observed the trouble with swallowing to be so serious that the patients have been admitted for stricture of the esophagus. That these cases are really due to the traction of the stomach on the esophagus seems proved by this, that the symptoms mentioned disappeared immediately and completely in all cases after gastropexy or after the employment of an effective supporting belt.

"As regards the stomach itself, the folds and bends mentioned, which, with virginal ptosis especially, are the result of the narrow space, give rise to serious and interesting complications and to the consequent conditions.

"I have already mentioned that, even where no trace of ulcer can be proved at the operation, hematemeses are not quite infrequent with gastrop-tosis. Such hematemeses are probably due to stasis in and swelling of the mucous membrane at the places where the wall of the stomach is creased.

"Finally, in a certain number of cases, the virginal ptosis leads to the development of an hour-glass stomach. I think, indeed, that I dare assert that the solution of the so long disputed question of the pathogenesis of the hour-glass stomach is to be sought for in the fixation of the creases of the prolapsed stomach caused by corsets and laces. The two theories which have hitherto stood in opposition to each other are, as is known, the conception that the hour-glass stomach is a congenital deformity as opposed to the ulcer theory, according to which the hour-glass form should be due to cicatricial shrinkage. Without venturing to deny the justifiableness of these two explanations with individual cases, I venture distinctly to insist that neither of them can be accepted as accounting for the great number of this astonishingly frequent disease; because, if a congenital hour-glass is proved at all, it is proved, at the highest computation, only in one or two cases, of which the demonstrative force is doubted even by Moynihan, the advocate of the ulcer theory. Now, as regards this, it may, when considered superficially, seem to be well founded in the fact that, with an hour-glass stomach, ulcerations or cicatrices are often found on the partition wall. But further reflection shows that the theory does not stand the test.

"The fact that we find an ulcer or a resultant cicatrix is really no proof that the ulcer is primary, because the hour-glass stomach itself, on account of the hindrance of the passage and on account of the stagnation and decomposition of the contents of the stomach, is greatly disposed to the development of ulcerations.

"Especially is there far more reason to believe that ulcer is secondary in the majority of cases where such ulcerations occur in the proximal part of the stomach. But in a great number of cases neither ulcer nor cicatrices occur.

"There is, in addition, another fact which is generally overlooked by most authors and which entirely precludes the correctness of the ulcer theory. What I am aiming at is this, that, while ulcer rotundum ventriculi is equally frequent with males and females, the serious forms which ought to be demanded for the development of such thorough changes are even more

frequent with men than with women, the hour-glass stomach being such a rare phenomenon with men that it must most appropriately be called a female disease. Here, so to say, the conditions quite resemble those of the gastrop-tosis. It was just this which directed my thoughts toward the possibility of the solution of the enigma, which the pathogenesis of the hour-glass stomach presents, lying in gastrop-tosis.

"The study of the clinical features and my operative experience have greatly strengthened this supposition. An investigation of the history of the disease as regards 26 cases of hour-glass stomach which I have personally observed shows that the first symptoms of the disease have always occurred during the years of puberty, when the subsequent, simultaneous misuse of the corset and the tight lacing commence. In their main features, these symptoms entirely resemble those of virginal ptosis. Little by little the increasing hindrance of the passage, the retention, and the dilatation in the proximal part of the stomach are maintained as an aspect of the disease, and, if hematemesis and melena occur in consequence of developing ulcerations, the aspect becomes more and more that of *ulcus stenosis*.

"By my numerous operations for gastrop-tosis, I have been able to observe all the stages of the development of the hour-glass stomach, in consequence of which I have formed in my own mind a consecutive view of this.

"With virginal gastrop-tosis, the bends of the creases occur essentially and naturally in two places: (1) On the lesser curvature at the transition between *pars cardiaca* and *corpus ventriculi* in the very place where the triangular solid ligamentum gastrophrenicum (called by some *pars condensae omentum minora*) ceases and is relieved by the more elastic portion of the omentum minus; (2) on the medial edge of ligamentum hepaticoduodenale where the free portion of the duodenum (with the pylorus) bends toward the fixed part.

"The hour-glass formation is generally due simply to the fine adhesions which form themselves in the folds of the serosa surfaces which rest one upon the other (Figs. 1 and 2).

"The development is some times greatly favored by this, that the omentum minus by coalescing with the omentum majus assumes a lace formation. With gastrop-tosis we very frequently find a complete loosening of the omentum minus, the central part of which subsides and hangs over the anterior side of the stomach like a tongue-shaped clump of the omentum. It may then come in contact with the tip of the omentum majus, and coalesce with this in a ribbon which draws a deep furrow in the stomach. The adhesion mentioned as occurring between the peritoneal surfaces, which I have seen in all stages, from those which are hermetically soldered, fixes the ptosis creases, and these, like partition walls, protrude into the lumen of the stomach.

"I have dwelt so explicitly on the aspect and pathological importance of virginal ptosis because it is still so unknown and so misunderstood, though it is now fourteen years since I described it for the first time. The other form is far better known.

"The Maternal Gastrocoloptosis.—This is the form we find with women whose abdominal wall consequent to past pregnancies and confinements has become distended, roomy, and relaxed. Hereby the intra-abdominal pressure is altered, and the support which the air-filled intestines offered to the subdiaphragmatic organs, as long as the vigorous elastic abdominal wall acted fails.

"With women whose stomachs lie in a normal and secure position at the moment when the relaxation of the abdominal wall commences, it depends entirely upon the strength of the ligaments whether a gastroptosis ensues at all. With strong women this does not occur; but with others, whose abdominal wall is less capable of resistance, a ptosis develops little by little; the development differing from the virginal ptosis in this, that the coloptosis is generally primary. The transverse colon, which is no longer borne up by the small intestine pelote, is weighed down by the heavy feces so that it hangs like a downward convex festoon suspended by the two flexures. The pull firstly affects the gastrocolic ligament and the mesocolon, which are elongated and dragged downward. It is quite common to find the gastrocolic ligament elongated from three to four times its normal length, when it is quite thin and perforated in many places. Secondly, it affects the stomach, the suspensory apparatus of which is also, little by little, stretched and elongated. The constipation and accumulation of fecal matter in the colon resulting from the coloptosis affects with steadily increasing strength the downward drag on the colon and the stomach. It frequently happens that the heavy, feces-filled colon lies right at the bottom of the pelvis and, like an anchor, holds the stomach fixed in its subsided position. Furthermore, the stomach can drag down with it the lower part of the esophagus, and then we encounter gastroptosis in its extreme form.

"With maternal ptosis the aspect of the symptoms differs from that of virginal ptosis in this, that the stomachic attacks—cardialgia and vomiting—are far weaker; are often, indeed, absent. It is due to the far more favorable conditions of space, as the stomach is not jammed or liable to be folded and bent as is the case with the virginal abdomen. For the same reason these patients do not generally suffer the innumerable pains and nervous sensations which characterize the others. That it is the distinction as regards space which causes the difference in the aspect of the disease is quite clearly perceived in the transition of a virginal ptosis to a maternal ptosis. So soon as the first confinement is overcome, a great improvement occurs in the condition of the patient so far as these symptoms are concerned.

"With maternal ptosis, the constipation with all its consequences is the dominant feature in the aspect. In course of time the effect of the auto-intoxication from the intestine reveals itself. The patient grows emaciated and sallow, suffers from headache and, in addition, from an ever-increasing sensation of subsidence, and from the unpleasant, depressing feeling that something is subsiding in the abdomen, and from an oppressive sensation of and feeling of fatigue across the loins. The drag of the subsided stomach on the cardia and the esophagus causes constant pain in the left side of the

epigastrium and, not unfrequently, difficulty in the passing of the food through the esophagus, so that a spasm of the cardia may arise. (Similar conditions sometimes occur with secondary dilatation of the esophagus.)

"It is characteristic of the disease that all these symptoms improve or vanish entirely with confinement to bed, while they at once recur or become worse with an upright position:

"The coprostasis may attain such stages that attacks resembling ileus may occur, and in extreme cases the stomach may also become so loose that volvulus ventriculi may occur."

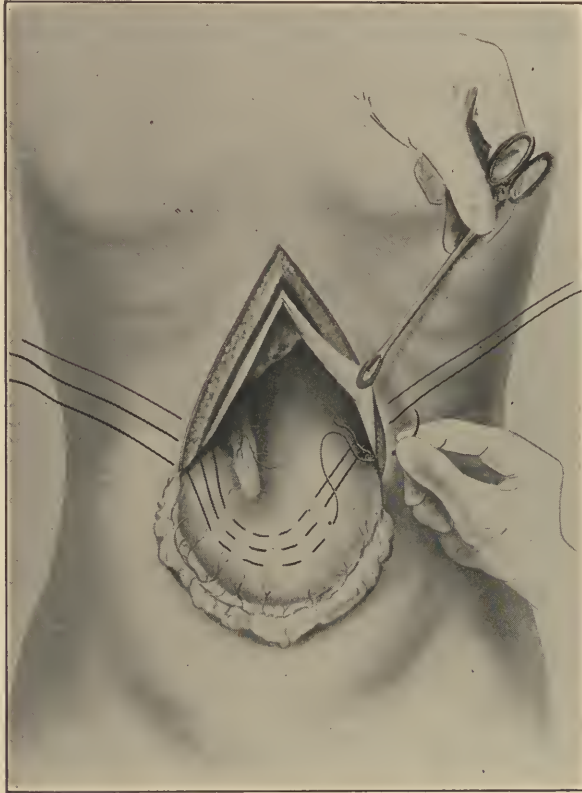


FIG. 135.—ROVSING'S METHOD OF GASTROPEXY.

Rovsing¹ describes the technic of gastropexy as follows:

"Parallel with the lesser curvature, I lead three strong silk threads in and out through the serous coating of the anterior surface of the stomach, leaving the pyloric portion free. The upper thread is placed close under the lesser curvature, and the two others, with an interval of about 2 cm., are placed in such a way that the greater curvature and a rather large piece of the wall above this are left free (Fig. 135). With a fine needle, the serosa coating between the threads is now scarified in all directions, also the surface

¹ *Ann. Surg.*, 1913, 57:1.

of the parietal peritoneum, and eventually that part of the under side of the liver to which one wishes the stomach to adhere. The ends of the silk threads are led out through the entire thickness of the abdominal wall; that on the left as far as the side of the rib curvature, and that on the right at about 3 cm. to the right of the center line. The peritoneum is now joined with catgut, and the fascia and skin with aluminum bronze, and, after the line of wound has been covered with collodion and cotton wool, the silk sutures are tied over a glass plate covered with sterile gauze (Fig. 136), the dimensions of which are a little larger than the stomach surface which

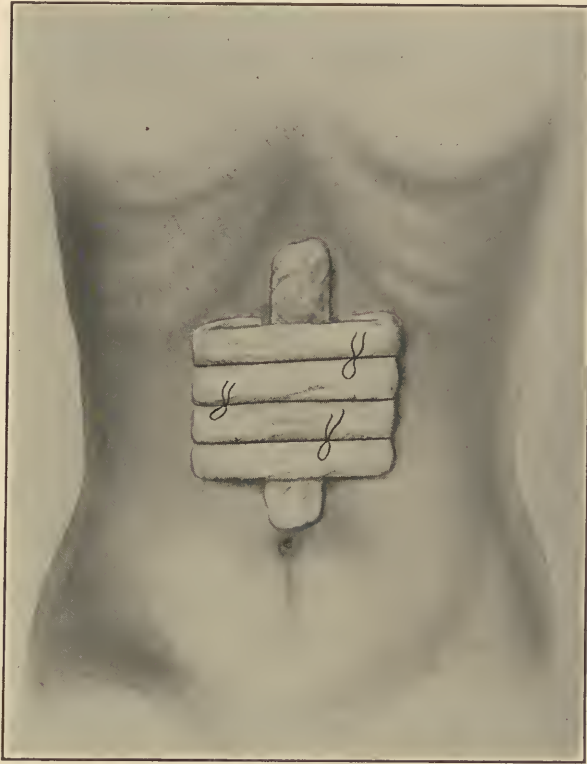


FIG. 136.—ROVSING'S METHOD OF GASTROPEXY.

The silk sutures are held over a glass plate.

has to be fixed. In this way it follows that the anterior surface of the stomach lies flat and close to the abdominal wall, without shrinkage and folding. These threads are left for four weeks and are then easily removed. A perfectly secure and solid adhesion is thus obtained."

My experience leads me to concede that the corset is probably an important factor in squeezing down the organs and narrowing the upper abdomen, but it is not the sole cause by any means. In fact, it is not the major cause. A large percentage of our cases with narrow chests and general ptosis have never worn corsets, particularly of the type which squeezes the chest.

We are prepared to concede that maternity, if not accompanied by compensatory fat referred to in Chapter XVI, may be a very important factor, but it is by no means the most important factor. It is important inasmuch as it lowers intra-abdominal pressure described in Chapter IV. The corset is far more important in cases of potentially congenital ptosis in which the organs have begun to sag themselves, and to leave the upper abdomen vacant.

It occurs to me that Rovsing had not completely differentiated the congenital and acquired types of ptosis. In addition to the features included in Rovsing's conception, I will present the following as my own conception, based on a considerable experience.

We have in Chapter III called attention to the provision nature has made for holding up the cecum and ascending colon, which is in reality a second stomach, by fusion to the posterior abdominal wall, and to the evils resulting to the failure so to fuse. We have in our embryological studies called attention to the fact that the stomach lies principally on the left side and hangs vertically from its firm supports at the esophagus. On the other side, the second portion of the duodenum is firmly fixed. The splenic flexure is firmly fixed and the hepatic flexure moderately fixed, but between the esophageal and duodenal fixation of the stomach in the one case and the splenic and hepatic flexures of the colon in the other case, the middle pyloric portion of the stomach and the transverse colon necessarily have very feeble peritoneal supports, considering their great weights when filled.

For anatomical reasons it has been impossible for nature to make fusion between the visceral and anterior parietal peritoneum. We have shown in the embryological studies how nature has attempted to remedy this as far as the transverse colon is concerned, first by fusing the posterior layer of the great omentum with the peritoneum of the transverse colon and mesocolon, and second by the obliteration of the omental bursa by the fusion of its two layers with each other. When this fusion has taken place, the colon has a second support from the bottom of the stomach in the form of the gastrocolic omentum. We find that in a considerable proportion of cases this second fusion or obliteration of the omental bursa has not taken place, in which case there is no functioning gastrocolic ligament, and, therefore, no support for the colon, which is derived from the bottom of the stomach.

In this type of cases, the transverse colon is especially prone to ptosis with sharp kinking at the splenic flexure and a subsequent development of a very obstinate constipation. In a normal individual where the proper fusion has taken place, these peritoneal supports are sufficient to hold the organs in position, as laid down by anatomists, in which case the stomach and intestines usually function properly. Unfortunately, nature's plans are often upset, even in a normal individual, by indiscretion and traumatic agents. Among these indiscretions we may first mention habitual constipation, which is developed usually in early manhood or womanhood, when enthusiasm is more markedly developed than discretion. Children in their enthusiasm and disregard for consequences fail to heed the warning of nature to evacuate the bowel at its normal time. This is repeated from day to day until finally

the presence of fecal matter in the large intestine and rectum is not detected by sensation. As a consequence, the bowel becomes loaded with solid matter. Active exercise often produces a severe strain on the supports of this loaded colon, gradually stretching its ligaments until it begins to sag. The splenic and hepatic flexures, having been normally fused to the parietal peritoneum, remain fixed, and especially is this true of the splenic flexure. As the transverse colon sags lower and lower, it is with more difficulty that the fecal matter is forced by the splenic flexure. It is probable also that these fixations become more firmly fixed, the result of the crystallization of the lines of force in response to the extra weight in accordance with Lane's law. The colon becomes heavier and the constipation worse. The intestinal

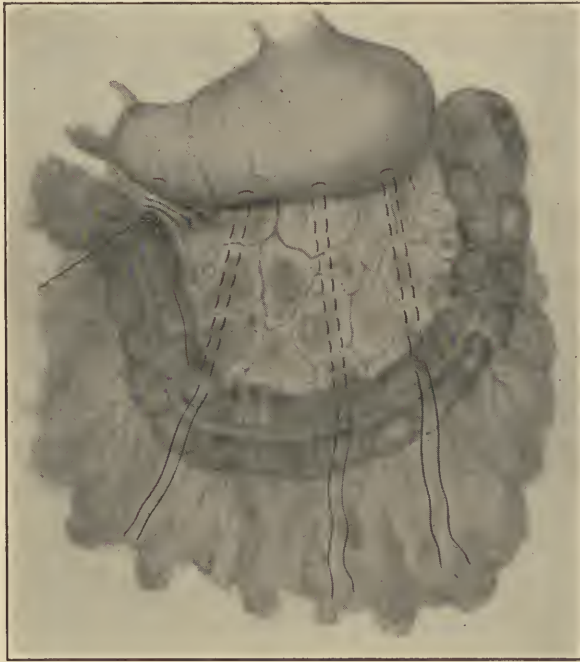


FIG. 137.—ROVSING'S METHOD OF SHORTENING THE GASTROCOLIC LIGAMENT.

canal becomes distended and the walls correspondingly thin and the patient is suffering from an obstinate constipation with toxic symptoms, which are described elsewhere. This condition probably occurs most frequently in the cases where the omental bursa has not been properly fused. The symptoms in this class of cases are nothing more than extreme constipation. The stomach is not involved. On the other hand, if the omental bursa has been properly fused, the stomach may be dragged down by the weight of the loaded colon acting through the gastrocolic omentum.

The mechanism may be well illustrated by the accompanying X-ray pictures (all taken in the same position) of the gastro-intestinal tract of a man thirty-eight years of age, who is lean, but whose stomach and bowel actions

are perfect as far as he is able to determine symptomatically, but whose stomach seems to be somewhat dilated and prolapsed and empties tardily. The first picture (Fig. 138), taken immediately after a meal of three and a half ounces of bismuth mixed with one pint of mashed potatoes, shows a transverse stomach, the upper margin of which is barely above the umbilicus and the lower margin nearly three inches below. The second picture (Fig. 139) was taken one hour later. It will be noticed that about one half of the bismuth was out of the stomach and in the intestine, and the stomach has risen almost an inch above the position it occupies in the previous pic-



FIG. 138.—X-RAY PICTURE OF STOMACH OF A MAN WHOSE DIGESTION IS SYMPTOMATICALLY PERFECT BUT WHOSE STOMACH EMPTIES TARDILY.

Picture taken immediately after a bismuth meal.

ture. The third picture (Fig. 140) was taken six hours after the bismuth meal. In this picture a small portion of the bismuth still remains in the stomach, a little has passed through the ileocecal valve and barely enough is in the transverse colon to show its position. It may be stated at this point that the subject's bowels had moved freely just before the bismuth meal was taken; therefore, the transverse colon was probably almost empty until the bismuth began to pass down. The bismuth at the time this third picture was taken, six hours after the meal, was nearly all out of the stomach,

and had not yet reached the transverse colon, except in very small quantity. The stomach and the transverse colon were, therefore, practically empty and the bismuth was between the stomach and the transverse colon. It will be noted in this picture that the stomach has risen so that its lower margin barely comes down to the umbilicus and the transverse colon is barely below the margin of the umbilicus. Now passing to the fourth picture of this series (Fig. 141), taken ten and one half hours after the bismuth meal, we find that the transverse colon has become filled with bismuth and presumably



FIG. 139.—X-RAY PICTURE OF SAME SUBJECT AS SHOWN IN FIG. 138, TAKEN ONE HOUR AFTER BISMUTH MEAL.

Stomach is half empty and has risen one inch.

fecal matter, and is seen nearly three inches below the lower margin of the umbilicus. A small amount of bismuth still remains in the stomach, which indicates that the lower margin of the stomach, which was slightly above the umbilicus before, has gone down with the loaded colon so that it is again two inches or more below the lower margin of the umbilicus. The fifth picture (Fig. 142) was taken twenty-two hours after the bismuth meal. The bismuth is now all out of the stomach and has moved on to the splenic side of the transverse colon and to the descending colon, sigmoid flexure and rectum. It will be noted that the transverse colon just in the line of the

umbilicus has emptied itself of the bismuth to a certain extent and the transverse colon has again risen to its normal position just below the umbilicus. The bowels acted soon after this last picture was taken, so it is quite probable that the transverse colon at this time was nearly empty, the fecal matter having passed on to the lower bowel preparatory to evacuation.

While the subject of these pictures is a perfectly healthy man and his food apparently passes through the entire alimentary canal in normal time, it is plainly seen that there is a tendency toward stasis in the stomach. It is



FIG. 140.—X-RAY PICTURE OF SAME SUBJECT AS SHOWN IN FIG. 138, TAKEN SIX HOURS AFTER BISMUTH MEAL.

A small amount of bismuth still remains in the bottom of the stomach which has risen to the middle of the umbilicus (two and one-half inches higher than in the first picture). Most of the bismuth is in the small intestine and cecum. A small amount is in the transverse colon, which swings across barely below the umbilicus.

but a short step from this mechanical condition to a ptosis which begins to show symptoms unless reasonable hygienic care is exercised. Gradually the stomach goes lower, until finally the difficulty of emptying it in the upright posture becomes more marked. The patient begins to suffer from dyspepsia and begins to take digestives. The condition becomes worse as the stomach goes lower and lower until finally the patient performs his or her duties with difficulty, and later becomes a complete invalid. If the condition goes on long enough, the stomach may permanently occupy the portion of the abdomen

below the umbilicus (see Figs. 134 and 143.) Fig. 143 shows how acquired bands and membranes, between a prolapsed transverse colon and the ascending colon and cecum, may make a midline ptosis permanent. My second case of midline ptosis was of this type and formed the subject of this picture. I have on several occasions found the transverse colon webbed not only to the ascending colon but the descending colon, as far down as the sigmoid, making the ptosis absolutely permanent and incurable by medical means. By cutting



FIG. 141.—X-RAY PICTURE OF SAME SUBJECT AS SHOWN IN FIG. 138, TAKEN TEN AND ONE HALF HOURS AFTER BISMUTH MEAL.

Transverse colon contains most of the bismuth and has gone down two and one half inches lower than shown in Fig. 140. Stomach still contains bismuth and has gone down with the colon.

these webs and bands and suturing the omentum to the abdominal wall, entire relief is obtained. The esophageal end is firmly fixed; the second portion of the duodenum is firmly fixed; the middle of the stomach is dilated; the length is greatly increased; and its upper margin is below the umbilicus. The pylorus, as we have had occasion to see in several surgical instances, is widely dilated, at times admitting three fingers, while a sharp kink exists at the junction of the first and second portions of the duodenum, corresponding to the position of the hepatic vessels and ducts. This condition has occurred in a previously normal individual and is often due to heavy lifting or overstraining, com-

bined with habitual constipation. Case 32 of our series of 41 cases reported² is in point. He was a German, a beer dealer, and prided himself on being able to lift a barrel of beer higher than any other man of his weight in the city. He was perfectly normal, and retained his strength until about two years before he came under my observation. He then began to develop stomach trouble, such as we have just described. He began to lose flesh until his weight went down to one hundred and nine pounds. He vomited his food regularly. Finally, a diagnosis of hour-glass stomach was made, with



FIG. 142.—X-RAY PICTURE OF SAME SUBJECT SHOWN IN FIG. 138, TAKEN TWENTY-TWO HOURS AFTER BISMUTH MEAL.

Most of the bismuth has passed into the sigmoid and rectum. Transverse colon has arisen two inches.

probable carcinoma. All the means of investigation were used, including X-ray, which was wrongly interpreted. When the abdomen was opened there was found to be absolutely nothing wrong with the stomach except a midline ptosis with gastric dilation, and the pylorus would easily admit three fingers. There was a very sharp kink at the junction of the first and second portion of the duodenum. In consideration of the history of the case, the occupation of the man, and the position assumed in performing the feat of lifting the

² *Surg., Gynec. and Obst.*, October, 1912.

heavy barrel on his abdomen, there is no doubt that this displacement was caused by lifting.

Case 37 is another case pointing even more directly to traumatic or acquired ptosis. This woman gave a history of stomach trouble dating back about twenty years. At the time of operation, evidence of a healed ulcer with a partial obstruction of the pylorus existed. No adhesions were present in the neighborhood of the pylorus. In addition, there was a sharp kink at



FIG. 143.—PTOSIS OF THE TRANSVERSE COLON WITH FIXATION TO THE ASCENDING AND DESCENDING COLON.

This has been described by the writer in an article on "Gastroptosis," *Philadelphia Medical Journal*, October 11, 1902, and also by Dr. Lewis S. Pilcher in an article on "Surgical Aspects of Membranous Pericolicitis," *Annals of Surgery*, January, 1912.

the junction of the first and second portions of the duodenum. As shown by the history, she had all the symptoms of gastric obstruction. About ten years before the operation and about ten years after the beginning of her stomach trouble, she was carrying a heavy load of wood in her arms, when suddenly she felt a severe pain in her abdomen, which caused her to remark to her family that something had ruptured inside. She was put to bed and remained there for a number of months. Since that time she has been an invalid to a certain extent, and has spent much time in bed. By remaining in bed her

stomach acted fairly well, and she was quite comfortable, but when up and about the stomach would scarcely empty at all. During this time she had a goiter removed, also the round ligaments shortened for uterine displacement at one of the world's great clinics, with no benefit. On opening the abdomen, the condition of the stomach and intestines shown in Fig. 144 was noted. A large opening easily admitting a man's hand, giving all the evidences of a tear, presented in the gastrohepatic omentum. Edges of the opening were

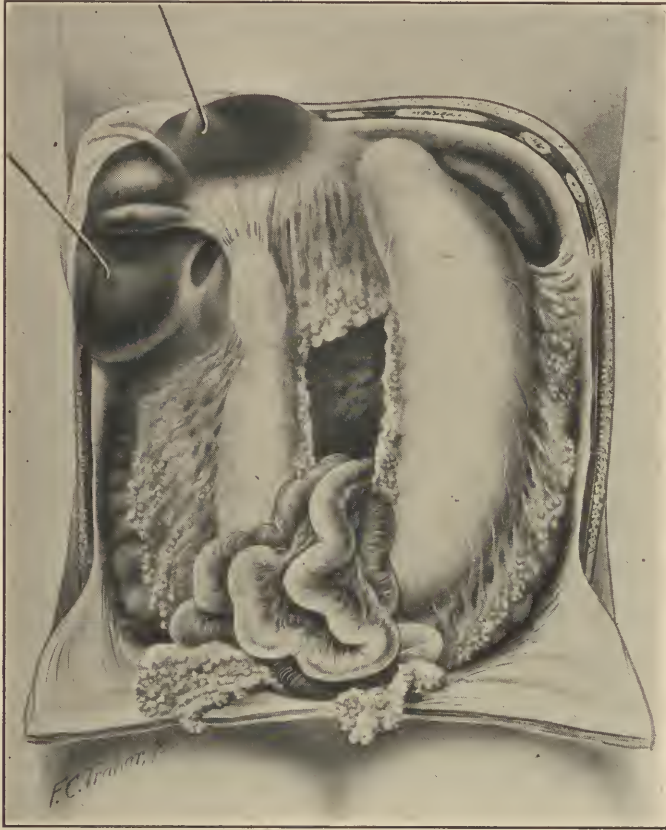


FIG. 144.—CONDITION EXISTING TEN YEARS AFTER WHAT SEEMED TO HAVE BEEN RUPTURE OF THE GASTROHEPATIC LIGAMENT.
Appearance at the time the abdomen was opened.

thick and comparatively fat, and showed unmistakable evidences of a scar. An opening equally as large presented in the transverse mesocolon, and also gave evidences of having been torn. Several feet of the small intestine had passed up through the opening in the mesocolon, the lesser peritoneal cavity, and through the opening in the gastrohepatic omentum. When the transverse colon was lifted up, the posterior wall of the stomach protruded through the mesocolon, as shown in Fig. 145. This case is unique, so far as I know, but taking the history and the condition found at the operation, there is very

little room for doubt that both these openings were the result of a tear at the time she was carrying the load of wood in her arms ten years before. It is quite certain that the predisposing cause of the rupture was a previously dilated stomach. The weight of the wood resting on the dilated stomach produced the rupture. The troubles of several of our other patients may be traced directly to heavy lifting.

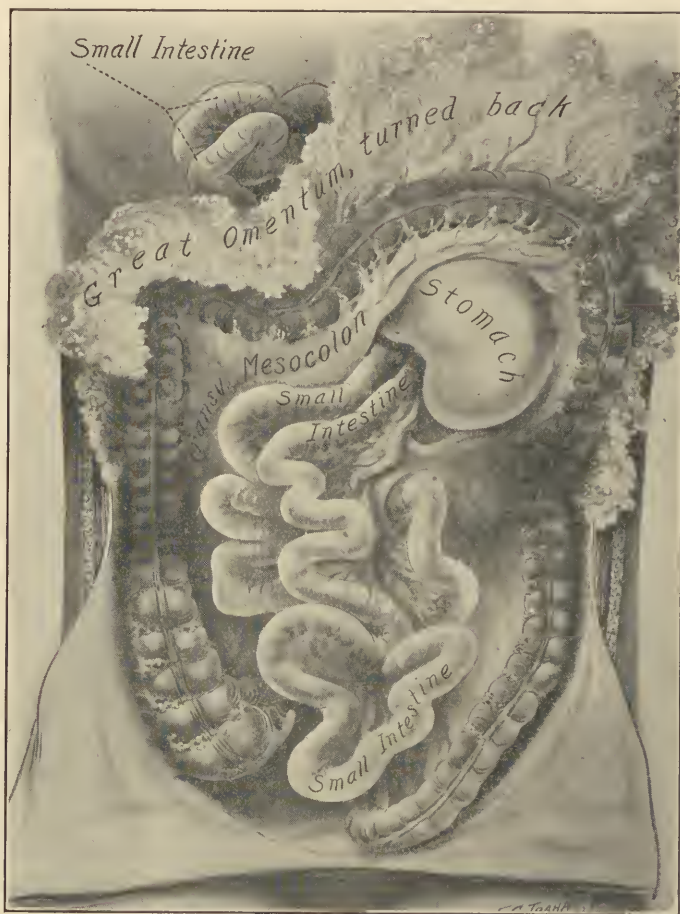


FIG. 145.—CONDITION EXISTING TEN YEARS AFTER SEEMING RUPTURE OF THE TRANSVERSE MESOCOLON.

Same case as Fig. 144.

Patient No. 12, a woman about forty years of age, presented herself weighing about eighty pounds after having been confined to her bed for three months. During the previous two years, she had devoted her time to the care of a sick husband, who had to be lifted constantly. Before the time of his death she became a bed-invalid. Operative findings: Stomach and colon in pelvis attached to parietal peritoneum by a few frail adhesions. No other organs displaced. The gastrocolic omentum was sutured to the peritoneum

one inch above the umbilicus. Recovery was complete within three months. The patient has remained perfectly well up to very recently, fourteen years after operation. She now weighs one hundred and forty-two pounds. X-ray pictures when last taken showed the colon somewhat lower than normal.

A number of other patients are Sisters who are nursing in the hospital, lifting patients. A number of others are teachers who stand in the school-room all day. All of these patients were apparently normal in their early manhood or womanhood. A moderate degree of midline ptosis may be greatly aggravated by adhesions following a pelvic inflammation or a surgical operation, making the ptosis permanent, even with the patient lying in bed. Patients with these marked symptoms usually give a history of being normal in their early years. The body formation is usually normal, except that the upper abdomen has contracted in its efforts to follow the stomach. The kidneys are not prolapsed.

The following histories will serve to illustrate these points:

Taking up case 26, we find a young man about thirty years of age. His father was a stock man and he spent his boyhood and early manhood as a cowboy until he developed symptoms of indigestion. He was examined and the symptoms could supposedly be traced to appendicitis. About six years ago, he was operated on and his appendix was removed, but the symptoms were not improved. He developed a hernia on the left side and about two years later a left inguinal hernia was repaired. Still the symptoms did not improve. About this time his father moved to the city and engaged in stock dealing. His health was not improved and he was troubled with indigestion and a nervous condition which unfitted him for the duties of his father's office. He had tried all forms of medical treatment, including that offered by a number of the ablest medical men in our section, but received no benefit. The last five doctors who examined him made a positive diagnosis of gastric ulcer with obstruction. The examination of his stomach contents showed hyperacidity. For several months prior to the operation, he had vomited a great deal of his food. For the six weeks prior to operation, he had vomited practically all of his food, and was so emaciated that he was unable to sit up. No X-ray pictures were made of his stomach before operation. His weight was not taken but was estimated to be less than one hundred pounds. He had every symptom of obstruction at the pylorus. His upper abdomen was permanently contracted.

On opening the abdomen and examining the stomach, it was found that there was no ulcer, and that the pylorus, instead of being contracted, was widely dilated, making the duodenum continuous with the stomach. The free margin of the liver was even with the umbilicus. The upper margin of the stomach was at least two inches below the umbilicus and presented the typical picture almost exactly the same as is shown in Fig. 134; transverse colon was in the pelvis. The omentum had adhered to the site of the operation for hernia and therefore had made the ptosis permanent. The point of obstruction was at the junction of the first and second portions of the duodenum. There was no other pathology present in the abdomen. The

adhesion holding the omentum to the left inguinal incision was cut, the stomach replaced, the ligaments of the liver shortened, the gastrohepatic omentum was shortened, and the great omentum was sutured to the parietal peritoneum midway between the umbilicus and the ensiform cartilage. The upper abdomen was expanded. The patient began to improve immediately, never vomited after the operation, was well in three months, and six months after operation weighed more than he ever did in his life and has had no symptoms referable to his stomach since operation. X-ray pictures eight months after operation show stomach and colon in normal position (Figs.



FIG. 146.—STOMACH IN CASE 26, EIGHT MONTHS AFTER OPERATION. Dotted white line indicates relative position before operation. Symptomatically cured.

146, 147). This patient had not been relieved by medical treatment and position because adhesions had made the ptosis permanent. He developed a gall-bladder infection ten years later. At operation the hammock was found perfect in unbroken continuity.

Case 27 was a hospital sister, forty-eight years of age, and was first seen January 6. She had been constipated all her life, and for twenty years had not had a bowel movement without a drastic cathartic. The past few years she had spent chiefly as an invalid. The members of her order had reached the conclusion that she was a hopeless neurasthenic and that she was not as sick as her complaints indicated. She had vague rheumatic pains over her

body, sallow and discolored skin, tenderness over the lower abdomen on both sides, anorexia, but no symptoms of gastric obstruction. Stomach analysis showed nothing abnormal. Distention of the stomach showed no marked gastropnoxis. An X-ray examination showed no marked gastropnoxis but an extensively prolapsed transverse colon, as shown in Fig. 148. On opening the upper abdomen, two gall-stones were found which had never given pain or a symptom which could be attributed to them. There were no adhesions in the abdomen, and no displacement of any other organ. The omental bursa



FIG. 147.—COLON IN CASE 26, EIGHT MONTHS AFTER OPERATION.
Dotted white lines indicate relative position before operation. Symptomatically cured.

had not been obliterated, which accounted for the prolapse of the colon without the stomach. The transverse colon was markedly distended and the splenic flexure markedly kinked without adhesions. The gall-stones were removed and the gall-bladder drained for a few days. The omentum was sutured to the abdominal wall midway between the umbilicus and the ensiform cartilage. The patient made an uninterrupted recovery and her bowels began to act without a cathartic before she left the hospital. At last report, eighteen months afterwards, her bowels were moving regularly and she was working every day. X-ray picture (Fig. 149) taken seven months after the operation shows the colon swinging across the abdomen just below the

umbilicus. This case is typical of the colon ptosis due to nonobliteration of the omental bursa.

Case 31, a female thirty-eight years of age, was a hospital sister and druggist. She was healthy in her childhood and young womanhood. Some time after she joined the Sisterhood, she began to have stomach trouble and was treated with the usual prescription of digestives of various kinds. As her case grew worse she was confined to her bed at intervals and did not feel well between the attacks of stomach trouble. Her skin was stained, abnormally muddy, and at times she had annoying skin eruptions. The case had been diagnosed on several occasions as gall-stones. She had been in bed for



FIG. 148.—COLON IN CASE 27 BEFORE OPERATION.

a number of weeks prior to the time the operation was performed, vomiting practically all food except when she was in bed. X-ray pictures showed displacement of the stomach and colon.

The upper abdomen was opened by a median incision and all the abdominal organs were examined. The stomach and transverse colon were markedly prolapsed, and the cecum was mobile. No other organs were displaced and no other pathology was found in the abdomen. The omentum was sutured to the abdominal wall, the gastrohepatic omentum was shortened, and the upper abdomen was expanded. The patient made an uninterrupted recovery and was back at her work as prescription druggist six weeks after the opera-

tion. She has been perfectly well since the operation. Ten years after she was seen personally, and was in perfect health, filling one of the most responsible positions connected with her order of Sisters.

Case 39 illustrates marked gastro-intestinal stasis due to a typical ptosis of both the stomach and the transverse colon. The patient, the wife of a farmer and timber man, was forty-three years of age, the mother of eight children, and had done most of her own housework during her married life. She had been constipated since childhood, the constipation growing worse in later years. For the few months prior to operation she had had spells of

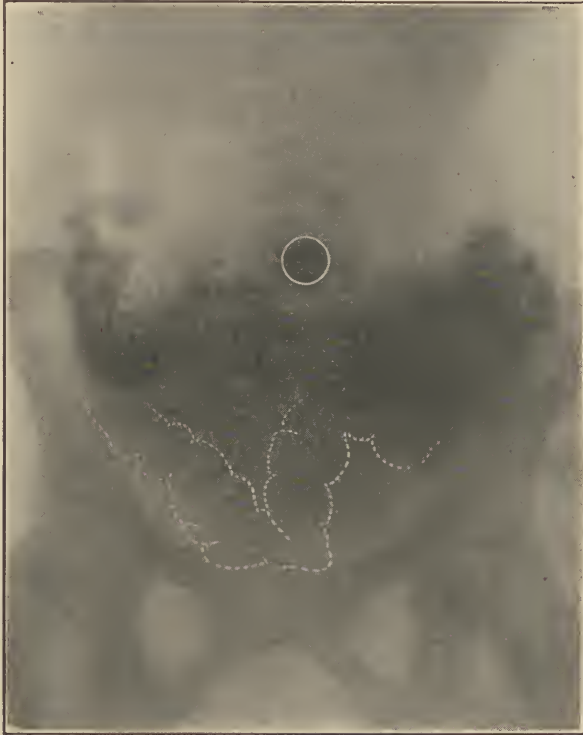


FIG. 149.—COLON IN CASE 27, SEVEN MONTHS AFTER OPERATION.
Patient symptomatically cured.

vomiting and no appetite. Her bowels had not acted oftener than once a week and then cathartics were necessary. Mouth was dry. She felt fairly comfortable while in bed and digested her food well. If she took even a drastic purgative early in the morning and remained on her feet all day, it would not act until the next morning. If she took the same dose at bedtime it acted within eight hours. A dose of oil, taken after she came into the hospital while lying in bed, acted well within six hours. The picture of the colon, taken twenty-four hours after a bismuth meal, showed bismuth in the cecum (Fig. 150). The pictures taken each day for three days thereafter showed the bismuth in the ascending and transverse colon. The picture taken ninety-

six hours after the ingestion of bismuth showed that none of it had passed the splenic flexure (Fig. 151). The patient presented a marked cachexia causing a provisional diagnosis of carcinoma to be made.

When the abdomen was opened May 14, 1912, the stomach and colon were found well below the umbilicus. The pylorus was widely dilated, admitting two fingers with ease. The transverse colon was greatly distended and its walls were thin. No evidence of gastric ulcer was found and there were no gall-stones. No other organs were displaced. A few light adhesions attached the omentum to the parietal peritoneum low down, and two or three bands



FIG. 150.—CASE 39 BEFORE OPERATION.

Bismuth has not passed the hepatic flexure in twenty-four hours.

extended from the transverse colon to the descending colon near the splenic flexure. These light bands were freed, the falciform ligament of the liver and the gastrohepatic omentum were shortened, the great omentum was sutured to the abdominal wall and the upper abdomen was expanded. The patient made a gradual recovery, the bowels acting well from the start, with a high enema. The stomach symptoms steadily improved until at the end of four weeks she was able to eat regular diet. At the end of eight weeks she left the hospital, at which time the bowels were acting without cathartics but, in order to ensure entire freedom from stasis for a while, she was given paraffin

to take when she went home and since that time has been taking a swallow of paraffin oil before breakfast. She reports that her stomach and bowels are acting well and that she is quite well eleven years after operation.

In mild or early cases in which no complications exist, midline ptosis is relieved by the reclining posture, for the stomach and transverse colon, in gravitating toward the diaphragm, release the kinks at the fixed points so that digestion and evacuation proceed normally. These cases may be greatly relieved and often symptomatically cured by a long period of rest in bed with



FIG. 151.—COLON IN CASE 39 BEFORE OPERATION AND NINETY-SIX HOURS AFTER BISMUTH MEAL. No bismuth has passed the splenic flexure.

forced feeding, which produces fattening. Unfortunately midline ptosis, if continued long, produces complications which make the condition self-perpetuating. The two principal complications are adhesions resulting from stasis or other inflammatory conditions, which hold the organs permanently out of place, and a permanent contraction of the upper abdomen resulting from the habitual absence of the transverse colon and pyloric portion of the stomach from that portion of the cavity. When the condition has continued long enough to produce either of these permanent complications, the problem becomes a mechanical one which can be relieved only by surgery. This con-

dition, unlike right-sided, or general, ptosis, is usually acquired and is found in patients who have previously been healthy. Habitual constipation and loaded colon, or overdistention of the stomach combined with hard labor or violent exercise, tend to stretch the peritoneal supports of these movable portions of the intestinal canal. The process once begun automatically grows worse, for the more obstinate the constipation or gastric stasis, the heavier the load for the supports, and consequently the lower the organs sag. The peculiarly weak point in the support of these parts of the alimentary canal is that they have a direct drop, being suspended only by the peritoneal supports. As has previously been shown, nature has taken two steps toward giving extra supports to the transverse colon; first, by fusing the posterior layer of the omentum to the mesocolon; and second, by the obliteration of the omental bursa. Other fixed points of the alimentary canal have been produced by fusion of the peritoneum of the organs directly to the parietal peritoneum. Thus it will be seen that, aside from taking advantage of shelves and angles, nature has depended chiefly upon making prenatal fusions to hold up the abdominal organs in fitting man for the erect position. When these fusions have failed, or the normal supports have given way, we can do no better than follow nature's example by making supplementary peritoneal fusion.

Rovsing has depended on suturing the stomach wall directly to the parietal peritoneum and reports 163 cases treated by this method. Of these 92 were completely cured, 24 were considerably improved, 18 slightly improved, 21 unimproved, and 8 died. This work of Rovsing, it must be admitted, shows better results than one would expect from such a radical procedure and deserves a place alongside of the work Lane has done in intestinal stasis, in that, while the cure in his cases had been produced by more heroic means than the condition would seem to warrant, it has certainly taught us much as to the nature and importance of the subject of ptosis and stasis.

On the other hand, Beyea has used a method which would be ideal if efficient. To one who has studied these profound cases of ptosis carefully and has noted how the gastrohepatic omentum is thinned until it has very little strength left, the Beyea operation cannot appeal very strongly as a method for producing a permanent cure. But it must be acknowledged to be a valuable aid in the treatment of the condition. The fact that the ligament has proved too weak to hold the stomach in the first place, when the shape of the abdominal cavity was normal and conducive to a normal position of the viscera, seems to be an ample argument that the patching up of this attenuated ligament to hold up a dilated and abnormally heavy organ in an abdominal cavity which has become distorted, and in a patient who has become generally depleted, is an entirely inefficient procedure. Furthermore, in cases of non-obliteration of the omental bursa, with ptosis of the transverse colon alone, the Beyea operation would be entirely inapplicable. The one tissue which can supply a ligament of extraordinary strength for both the colon and the stomach is the great omentum, picked up just below the colon and sutured to the anterior abdominal wall.

Basing the treatment on the principles which have been set forth in this

book, in a given case of midline ptosis involving the free edge of the liver, the pyloric portion of the stomach, and the transverse colon, and in which the upper abdomen has contracted, the following operative procedures are indicated:

An incision is made in the exact median line, beginning at the ensiform cartilage and extending about one inch below and to the left of the umbilicus and through the skin and fat. The fat is now pushed off the aponeurosis until the interlacing of the fibers of the aponeurosis of the two sides is thoroughly exposed. If the incision is made at the exact point of the interlacing

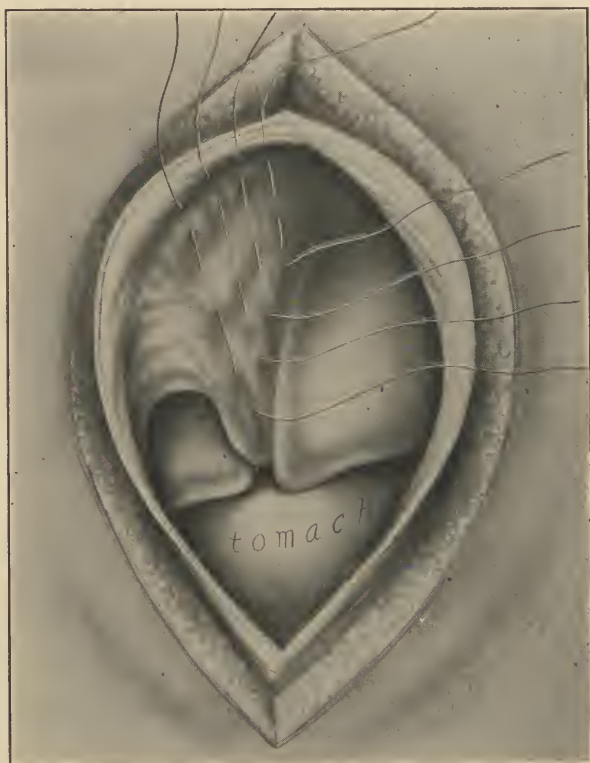


FIG. 152.—SHORTENING THE FALCIFORM LIGAMENT.

of these fibers, the opening of the sheaths of the recti muscles will be avoided. This precaution is taken with a view of expanding or relaxing the upper abdomen at the time of closing. After the abdomen is opened, the organs examined, and the necessary operation determined upon, the first step is reposition of the liver, which is done as follows:

The falciform ligament, which is elongated, is shortened by purse-string sutures of chromicized catgut, taking two or three bights in the ligament and finally fastening to the parietal peritoneum (Fig. 152). Three or four of this kind of sutures are used. After this a number of quilt sutures are used to fasten the edges of the right and left lobes of the liver to the parietal

peritoneum. These sutures are passed from the outer side of the subperitoneal fascia inwards through the liver and back out through the peritoneum and tied on the outside of the subperitoneal fascia. From three to five sutures are used on either side of the falciform ligament. This new ligament has the shape of a Y, the original falciform ligament being the stem (Fig. 153). The second step is the reposition of the stomach and transverse colon by suturing the omentum to the abdominal wall. The incision is held wide open by retractors, and the parietal peritoneum at the edge of the wound is pulled

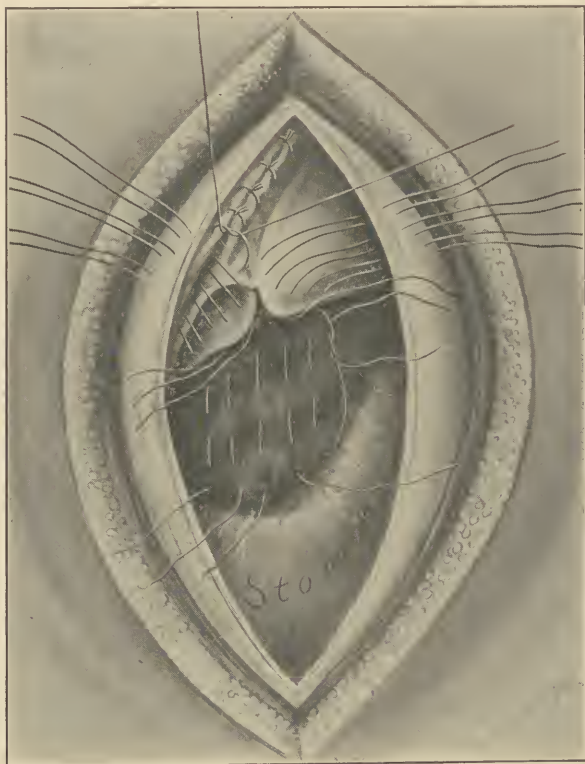


FIG. 153.—FALCIFORM LIGAMENT SHORTENED.

Sutures passed through the right and left lobes of liver for making a Y-shaped ligament. Sutures placed for shortening gastrohepatic omentum by Beyea's method.

out as far as possible, especially on the left side. A needle armed with chromicized catgut is passed through a good bite of the parietal peritoneum at the point on a line crossing midway between the ensiform cartilage and the umbilicus, and as far toward the left as the sutures can conveniently be placed with a needle holder. (In some instances we have closed the space entirely to the costocolic ligament.)³ The omentum below the greater curva-

³ In my first case on which omentocolopexy was performed, only 3 sutures were used. In the second case, 8 sutures were used in the central portion of the abdomen. Now we use any number that seems to suit the case. Any operation, which fastens the omentum to the anterior abdominal wall for the purpose of supporting the stomach or colon, is termed "hammock operation."

ture of the stomach is then inspected, and the direction of the vessels examined and the needle is passed through a bight of the gastrocolic omentum one and one half inches below the lower border of the stomach. The omentum is now turned up and the same suture is passed, taking the second bite through all the layers of omentum just below the colon as shown in Figs. 154, 155, 156, 157, 158. The two ends of the suture are now tied, the next suture is placed about one half inch nearer the median line. After three or four sutures are thus placed on the left side, it is well to place a like number on the right side so the normal relations may be preserved. Do not place the sutures



FIG. 154.—METHOD OF PLACING SUTURES IN DOING THE "HAMMOCK" OPERATION.

as far from the median line on the right as has been done on the left side, owing to the fact that the stomach is a left-sided organ. The operator now has his bearings and may place sutures on the right or left side, as seems best, until the line of sutures is completed to the edge of the parietal peritoneum and to a point near the center of the omentum. The omentum should be allowed to relax and should be inspected before the placing of each suture so as to avoid the blood-vessels and so to place the sutures that the omentum will come in contact with the parietal peritoneum without tension or twisting. When the sutures have been placed to a point within one and one half inches of each other in the center, it is well for the operator to begin to close the peritoneum of the abdominal wound from above with chromicized catgut and sew down with a continuous suture to a point where the omentum is being

attached to the abdominal wall, when he may take one or two bites of the omentum in his continuous sutures and thus finish the hammock. With the same sutures he now continues and closes the peritoneum to the lower end of the wound. In some instances the omenta are very thin and stretched out. Dr. L. S. Pilcher has passed some of the sutures through the transverse mesocolon. I have used this modification with great satisfaction. (See inserts in Figs. 155, 156, 158.)

Dr. Charles A. L. Reed of Cincinnati has described an operation under the name of "Parietal Implantation of the Colon,"⁴ in which he makes an

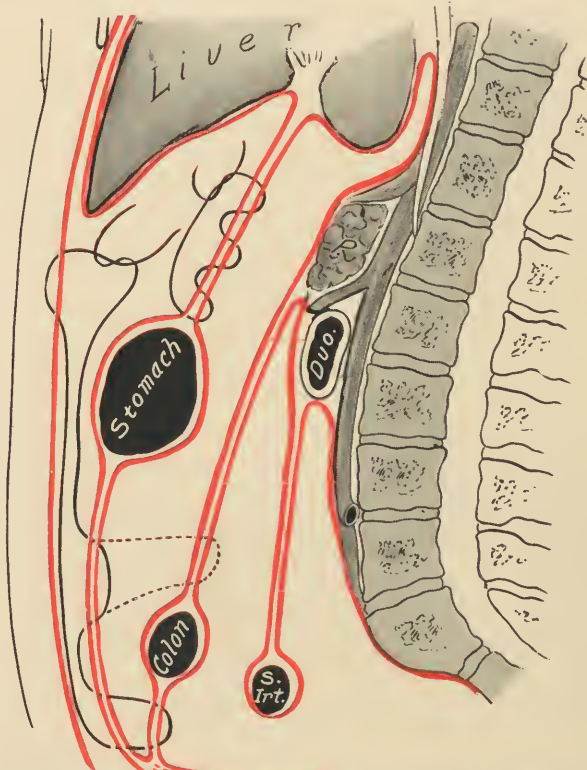


FIG. 155.—DIAGRAM ILLUSTRATING THE PLACING OF SUTURES FOR SHORTENING THE GASTRO-HEPATIC OMENTUM AND FOR SUTURING THE GREAT OMENTUM TO THE ABDOMINAL WALL IN "HAMMOCK" OPERATION.

Dotted suture line grasps mesocolon.

incision transversely across the intercostal interval about three fourths of an inch below the tip of the ensiform cartilage, extending the same incision at an obtuse angle downward and to the right about a half inch below the costal margin for a distance of from five to six inches. This incision divides (a) the integument, (b) subcutaneous fat, (c) superficial fascia, (d) inner half of the left rectus, (e) all of the right rectus, and (f) the inner margins of the external oblique, internal oblique and the transversalis muscles, and finally,

⁴ *Journ. Am. Assoc.*, September, 1916, vol. 67.

(g) the transversalis fascia through the entire length of the incision, care being taken not to extend the incision along this line through the peritoneum. He then opens the peritoneum and stitches the omentum to the denuded transversalis fascia by stitching the base of the former by its external surface to the lower margin of the denuded surface of the latter, employing a continuous button-hole suture (Fig. 159).

Without going into the finer details which he describes, I think I am justified in saying that such an operation which cuts so many important structures is totally unnecessary. A properly performed omentopexy combined with

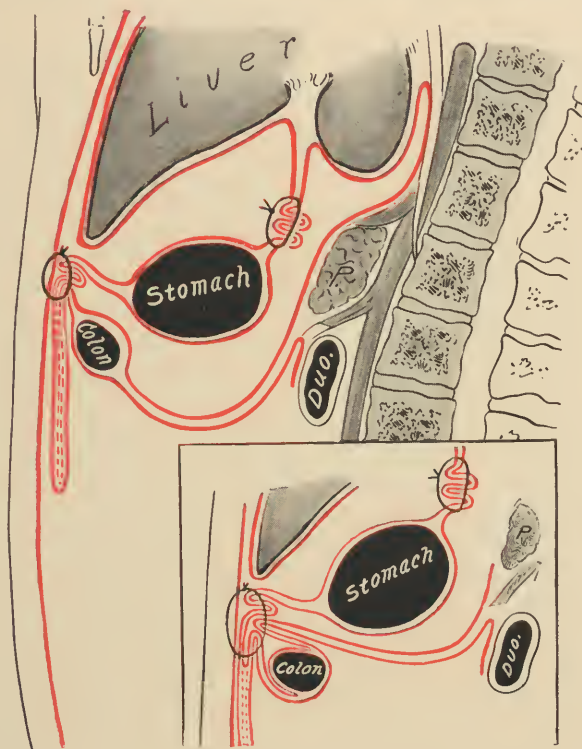


FIG. 156.—SCHEME OF COMBINED BEYEA OPERATION AND "HAMMÖCK" OPERATION. Insert shows Pilcher's method of inclusion of mesocolon in sutures.

right indirect colopexy, as shown in Figs. 128 to 130 inclusive, never gives way and involves no important tissue. Peritoneal surfaces are brought together by interrupted sutures tied sufficiently tight to make pressure enough to squeeze out endothelial layers and produce direct union of the fibrous layer of peritoneum which is as firm as the continuity of the peritoneum itself. I have seen more than 20 cases years after omentopexy and in every instance have found the omentum attached to the parietal peritoneum exactly where I left it.

Postoperative Treatment for Abdominal Ptosis.—Of the 363 patients operated upon for ptosis, 5 died, 1 from pneumonia, 3 from pulmonary

embolism occurring from ten to fourteen days after operation and 1 from acute sepsis developing in the abdominal wall. It is interesting to note that the 3 deaths from embolism occurred during the first 150 cases, at which time a part of the postoperative routine was to keep the patient flat on the back for one week. On the death of the third patient, a postmortem was done. It was found that the clot had come from the left iliac vein. The internal iliac vein with all of its branches contained a firm clot, the end of which fitted on to the clot found in the pulmonary artery. I have every reason to believe that, in the other two cases, the clot was formed at the same place and I believe it is probable that, in most cases of sudden death



FIG. 157.—COMPLETE BEYEA OPERATION AND "HAMMOCK" OPERATION.

This is shown by reflecting the upper part of the abdominal wall downwards after the operation is complete, including the closure of the abdominal incision.

from pulmonary embolism following simple abdominal operations, the clot forms in this way and is due to the well-known anatomical anomaly found in certain individuals in which the artery crosses the outlet of the left internal iliac vein in such a way as to obstruct it with the patient lying on the back. In certain instances, possibly under certain blood conditions, it seems that the blood in the internal iliac vein becomes slowed to such an extent that a clot forms. This clot breaks away from the tenth to the fourteenth day and it usually occurs in patients feeling perfectly well. In every one of my cases, the patient has been especially hilarious just before death took place. Since the lesson of this postmortem, every patient, following an abdominal opera-

tion, has been turned on the right side, with the legs drawn up, for one hour after being put to bed and has then been turned to the left side for one hour; from that time on the patient changes position, first to the right side, then to the left side, then to the back, for the first three or four days after operation, exception being made when the patient is in the semisitting posture with legs drawn up such as is used in abdominal drainage cases and following stomach operations. Since adopting this plan, I have had no sudden death from pulmonary embolism in approximately 1,500 abdominal operations,

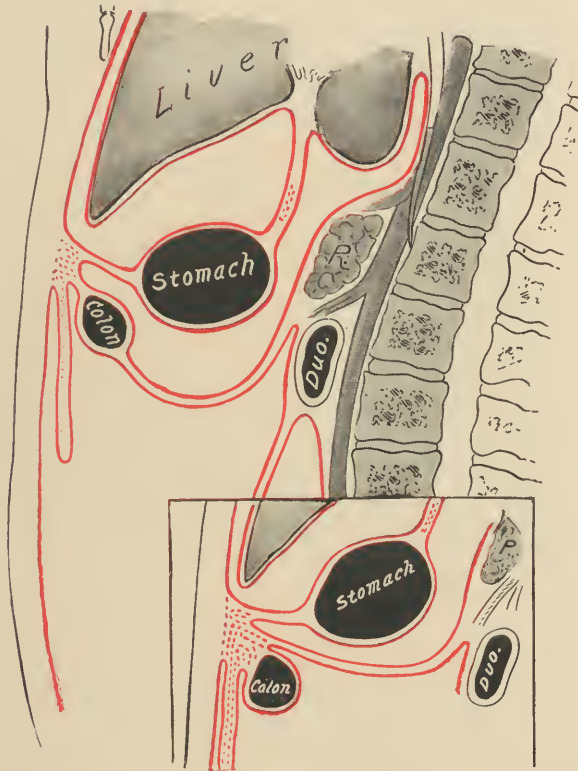


FIG. 158.—RESULTS FOLLOWING COMBINED BEYEA OPERATION AND "HAMMOCK" OPERATION. Insert shows Pilcher's method of inclusion of mesocolon in sutures.

whereas I had 7 deaths from this cause in approximately the same number previous to the adoption of this plan.

I have often wondered whether the 3 patients who died from embolism might not have been alive to-day if this plan had been adopted. At any rate, I now believe that it is a necessary part of the postoperative treatment.

At the end of two weeks after the stitches have been removed and it is possible to use the hot packs over the abdomen, the forced feeding and bowel regulation set forth in Chapter XVI on Medical Treatment is begun and

continued for two weeks with the patient in bed. Four weeks after the operation, the patient is allowed to sit up, continuing the forced feeding. After an adequate amount of fat is accumulated, the patient is encouraged to start walking, gradually increasing the distance each day. In the course



FIG. 159.—BOTH INCISIONS CLOSED WITH THE COLON IN ITS RESTORED POSITION. (Reed.)

of two or three weeks after beginning to walk, such a patient will be walking four or five miles and will have gained on the average of from twenty-five to forty pounds in weight. It should be made very clear to the patient that this flesh must be kept up, exercises maintained and bowels kept regular. Other cases will require longer medical treatment.

CHAPTER XIV

DUODENAL ARTERIOMESENTERIC ILEUS

Duodenal arteriomesenteric ileus is an obstruction of the duodenum at the end of its third portion as a result of traction on the superior mesenteric vessels by the weight of that portion of the gastro-intestinal tract which the artery supplies.

The development of this subject and its treatment within very recent years has given the ptosis question its most dramatic thrill. It is quite possible that careful study of this subject is going to explain many of the so-called functional diseases of the upper abdomen. The crossing of the end of the third portion of the duodenum by the superior mesenteric artery and vein is probably responsible for a large portion of the perverted physiology of the duodenum and the organs whose ducts empty into the duodenum.

There are two elements in the ptosis question which may produce this traction. One is the mobile cecum with a long mesentery which permits a direct drop of the loaded colon into the pelvis through the *psaos outlet*. In such a case more or less traction on the superior mesenteric vessels is probable. The other element is marked loss of fat, which, in addition to producing a general reduction of intra-abdominal pressure, also thins the mesenteries of the small intestines so that they become elongated and permit the intestines to fall through the *psaos outlet* over the pelvic brim into the pelvis. Thus, the weight of the entire small intestine, with its contents, drags on the duodenum and tends to obstruct it, thereby producing stagnation of its contents. This explains why certain ptotic patients do well only when the foot of the bed is elevated during most of the time for the first three or four hours after meals and in certain extreme cases it is required that the patient's hips be markedly elevated by the knee-chest position, or even by such maneuvers as putting the head and chest off the side of the bed on pillows resting on the floor, while the hips remain on the bed.

It is frequently noted on the operating table that a dilated mobile cecum, also prolapsed small intestines, are delivered from the pelvis only by considerable force. The simple recumbent posture does not permit sufficient slack on the mesenteries and the superior mesenteric artery to release the obstruction. Therefore, relief is obtained only when the head is sufficiently low to permit the intestines to gravitate out of the pelvis.

With this conception of duodenal arteriomesenteric ileus in view, the rational treatment is apparent. If the condition is due to mobile cecum, it should be fixed surgically. If it is due to drag by the prolapsed small intes-

tines on their mesenteries and mesenteric artery, the treatment consists of forced feeding and fattening with the patient's head sufficiently low (sometimes requiring the knee-chest position) to permit the intestines to gravitate out of the pelvis until such time as the fat has shortened the mesenteries, increased intra-abdominal pressure and narrowed the *psaos outlet*. In extreme cases in which the vessels and their surrounding connective tissues have taken on reinforcement in the form of crystallized lines of force and the intestines have established a permanent habitat in the pelvis, the duodenum has become permanently dilated and the obstruction is more or less fixed. In a few of such cases, it will be necessary to do a duodenojejunal anastomosis.

About seventeen years ago, I was called in consultation to see a female patient fifty years of age. She had been vomiting for several weeks. The vomitus contained bile but no blood and no free hydrochloric acid. There was no palpable tumor present to act as an obstruction. She had lost considerable weight and had what we now term the "acidosis breath." By introducing solutions into the rectum, the life of the patient had been kept up so that while she was thin, her general appearance was not what we would have expected to accompany a malignant condition. She had never had severe abdominal pain, but on two or three occasions had had attacks similar to this.

One thing concerning the importance of fat, which in our present light becomes interesting, is that she had lost flesh for some unknown reason preceding the beginning of the present attack of vomiting which led us to fear possible malignancy on the lesser curvature of the stomach. After several days' observation and all investigation at our command, for at that time we were not using the X-ray for gastro-intestinal diagnosis, we frankly admitted to the patient that we could not determine the trouble and suggested that our next step should be an exploratory operation to determine the nature of her trouble.

She was sent to the hospital for operation the following morning. For some reason the operating room was engaged. In the meantime some members of the family had urged a mechanotherapist of some new variety. I told them I was unable to see how it could be of much benefit but, by the time I was able to get the operating room, the patient had definitely decided not to have an exploratory operation but to permit the mechanotherapist to try his hand.

I heard nothing more of the patient for more than two years. One day in a public gathering, a very healthy, stout, middle-aged woman touched me on the arm and said, "You don't know who I am, do you?" I said, "I do not." She said, "I am the patient on whom you wanted to operate for cancer two years ago." She seemed very friendly, so I asked her how the transformation had been brought about. She said, "You know the mechanotherapist that we had found that I had a kink in the intestine so he stood me on my head for several days and rubbed out the kink. My vomiting ceased, my appetite returned and I soon got fat with the result that I am now perfectly well."

About this time and for some years later, I began to notice the writing

of Franklin Martin and Goldthwait, describing their methods of treatment of ptotic individuals by posture. We soon learned that the majority of these asthenic ptotic patients would gain flesh in the recumbent posture by the industrious application of the hot pack. Among these patients, however, there were a number who were unable to take the food, who would vomit and complain that the milk made them bilious. Some of these patients, we soon found, were better treated with the head lowered and in certain cases by elevation of the hips into a moderate knee-chest position by placing the patient on the face and supporting the lower abdomen about the pubes with pillows. In other cases, we found that by suspending the trunk over the edge of the bed with the chest and head lying on pillows resting on the floor, while the hips remained in bed, the patient would usually immediately begin to improve. Digestion would get better.

After this treatment had been followed up for several weeks, the patient finally was cured of the nausea and anorexia, this improvement seeming to come with the deposition of fat within the abdomen. In some cases of this kind, we operated, expecting to find an organic obstruction in the duodenum. To our amazement, we found in practically all instances a dilated duodenum, sometimes existing to such an extent that the duodenum seemed to be a continuation of the stomach. Even in these early years, we noted that the duodenum below the mesocolon was sometimes widely dilated. It became apparent to me that these cases of dilated duodenum were found almost entirely in the group which we call "ptosis patients." We noted that these patients were usually relieved by fixation of the cecum and suturing of the omentum to the abdominal wall.

In December, 1911, I saw Bloodgood in his clinic perform a colectomy for a condition of this kind, at which time he made the statement that he had done this operation on previous occasions with very satisfactory results. He felt that ptosis was the cause of the drag on the duodenum and that removal of the cecum seemed to meet the indications. This seemed somewhat far-fetched and I paid very little attention to it.

Since that time, by carefully studying the literature on the subject, as well as by carefully observing my own cases, the conception expressed at the beginning of this chapter has been formed. I now feel sure that the first case related in this chapter was cured because the "mechanotherapist" lowered the patient's head, allowed the small intestines and cecum to gravitate out of the pelvis and supplemented this by massage over the duodenum which helped it to empty. She was kept in bed for several weeks, gained many pounds of fat, increased her intra-abdominal pressure, shortened and thickened her mesenteries and narrowed the *psoas outlet* which completely released the drag on the superior mesenteric vessels. We also now understand why certain ptotic patients who could not be successfully treated by forced feeding and rest in the recumbent position were immediately relieved and began to gain when they were turned on their faces with the hips elevated.

The mechanism by which the superior mesenteric vessels obstruct the terminal portion of the duodenum is shown by rehearsing the steps in embryo-

logical rotation of the gastro-intestinal tract. The loop of primitive bowel which leads to the umbilicus contains the primitive vessel supplying all of the intestinal tract (Fig. 160). It is the superior mesenteric artery. After the loop has detached, the length of the bowel begins to increase (Fig. 161). This vessel continues to supply the small intestines and the first half of the large by its terminal branches. As the large intestine rotates upward and over to the right, the small intestines turn in underneath and locate on the left

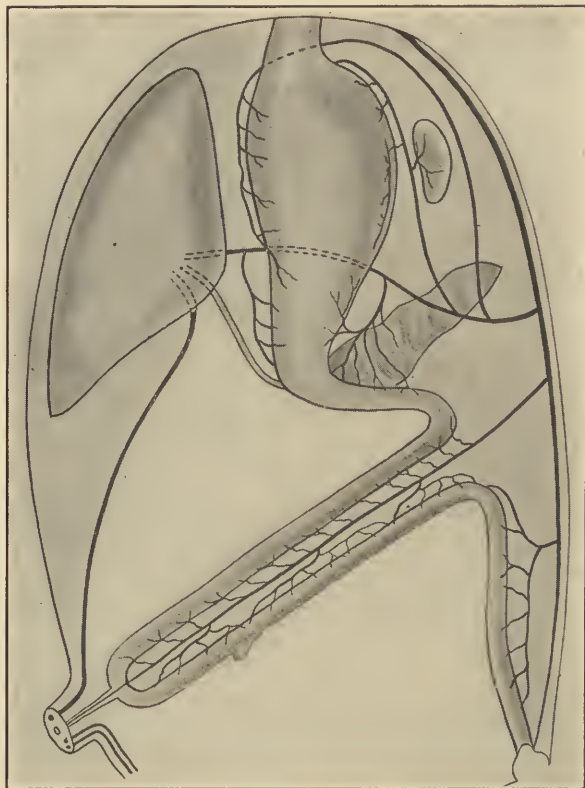


FIG. 160.—FIRST STAGE OF THE DEVELOPMENT OF THE INTESTINAL CANAL AND THE PERITONEUM SEEN FROM THE SIDE. (Redrawn from Sobotta and McMurrich.)

side. This rotation brings the superior mesenteric vessels directly across the end of the third portion of the duodenum (Figs. 162, 163, 164, 165).

In the absence of normal prenatal fixation of the ascending colon, or in the absence of the normal intra-abdominal fat and intra-abdominal pressure, an individual becomes a potential subject for duodenal arteriomesenteric ileus.

Stavely¹ gives a history of gastromesenteric ileus and states that Rokitansky knew of it in 1842; Fagge reported cases in 1872 and 1873. H. Campbell Thompson in 1902 discussed the subject exhaustively. Glenard, Byron Robinson and Albrecht followed with the statement that mesenteric ligament or mesenteric artery was the cause. Glenard believed it to have a

¹ *Surg., Gynec. and Obst.*, September, 1910, 11:288.



FIG. 161.—SECOND STAGE OF THE DEVELOPMENT OF THE INTESTINAL CANAL AND PERITONEUM SEEN FROM IN FRONT. (Redrawn from Sobatta and McMurrich.)

The cecum and large intestine, as shown in this picture, gradually move upward and to the right side, and then downward; and the small intestines turn underneath and are thrown to the opposite side as shown in Fig. 162.

physiological purpose for holding duodenal contents in. It has been demonstrated that prolapse of the collapsed small intestines into the pelvis would produce it. Glenard estimated the pull of the empty intestines at 500 gm. Prolapse may follow relaxing of abdominal wall.

In the development of the pathology of this condition, Bloodgood² was

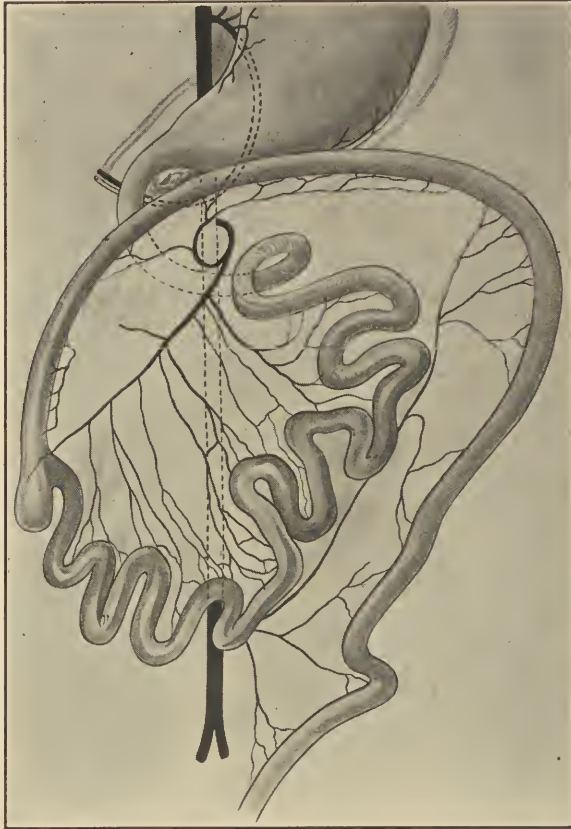


FIG. 162.—NORMAL POSITION OF INTESTINE AFTER ROTATION. (Redrawn from Sobotta and McMurrich.)

This shows how, by the process of rotation, the duodenum is thrown behind the mesentery of the transverse colon and thereby becomes retroperitoneal. The superior mesenteric vessels have by this process of rotation been brought across and in front of the third portion of the duodenum.

one of the early investigators to throw definite light on the subject. He reports a postmortem held on one of Finney's patients after a pyloroplasty as follows:

"In Fig. 166 the small intestines have been removed; the stomach is not dilated. The characteristic changes in the anatomy of the pylorus after a Finney pyloroplasty are beautifully shown; the dotted lines represent the suture. Just below this in the duodenum there is a kink always observed after this operation, but which has produced no obstruction. The suture had

² *Ann. Surg.*, 46:736.

healed perfectly; it was covered with a thin fibrinous exudate and slightly adherent to the liver. The dilatation of the duodenum and its marked U-shape is well shown. When I cut away the transverse colon and the small intestines, the dilatation of the duodenum up to the mesenteric vessels and the collapsed jejunum forming the S curve were distinctly seen, and are shown in Fig. 166. When I cut the jejunum near the mesentery, it was empty and nothing escaped. When I pressed upon the duodenum there was no leakage. But when I passed my index finger through the jejunum into the duodenum, a large quantity of thin, brown fluid escaped, and the duodenum collapsed. At operation, therefore, in Case 1, and at autopsy in Case 2,



FIG. 163.—DIAGRAMMATIC PICTURE OF DUODENAL ARTERIOMESENTERIC ILEUS.

This shows how the third portion of the duodenum is obstructed by mesenteric vessels resulting from the weight of prolapsed intestines in certain forms of ptosis.

compression of the duodenum could not force its contents past the obstruction behind the mesenteric vessels into the jejunum. It seemed to me there was a valvelike kink due to the tension of the distended duodenum, and not to traction on the jejunum by the weight of the small intestines—an explanation quite frequently given in the literature.”

Bloodgood reports three other cases in which he has complete operative and autopsy findings and makes the following observations:

“In all three cases, the obstruction began abruptly at the junction of the duodenum and jejunum, beneath the mesenteric vessels. In Case 1, the duodenum and stomach were tremendously dilated, the duodenum fixed in a high position. In Case 2, at operation, the stomach and duodenum were mod-

erately dilated; there was no positive evidence of pyloric obstruction; the duodenum was not examined in its third portion; at the autopsy in this case

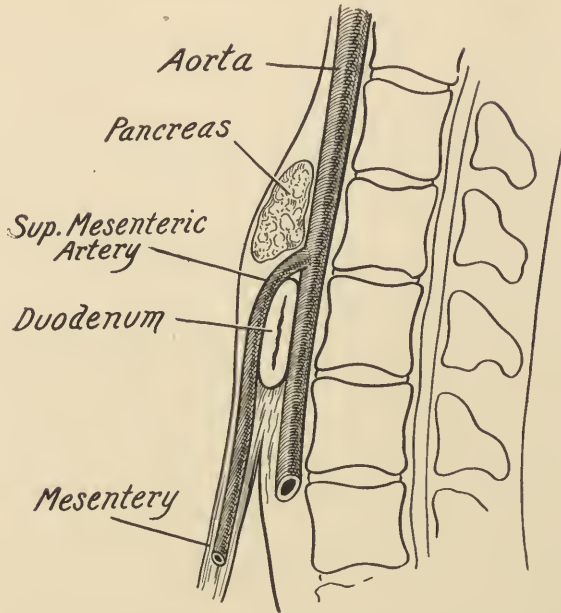


FIG. 164.—SAGITTAL SECTION SHOWING HOW DRAG ON SUPERIOR MESENTERIC VESSELS OBSTRUCTS THIRD PORTION OF DUODENUM.

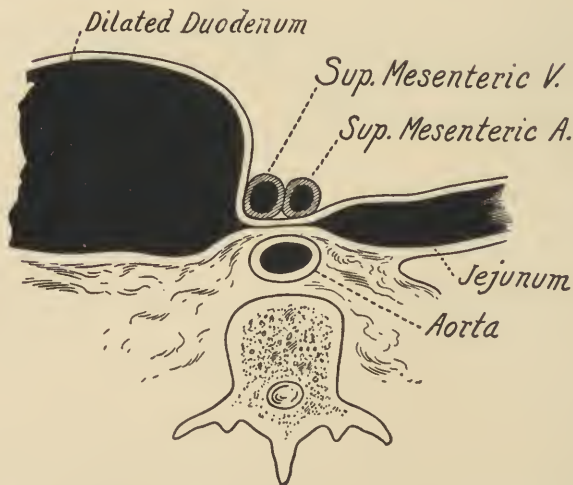


FIG. 165.—DIAGRAM SHOWING MECHANICS OF DUODENAL ARTERIOMESENTERIC ILEUS AND WIDELY DILATED DUODENUM.

the duodenum was dilated down to the mesentery, the stomach was only moderately dilated. In Case 3, the duodenum and stomach were but moderately dilated, but the duodenum, except in its lower third, was abnormally

movable. Case 1 is a typical example of primary acute dilatation. We know nothing about the condition of the stomach and duodenum before the attack. Cases 2 and 3 give a clinical history which resembles a gastric neurosis more than pyloric stenosis or ulcer. I am of the opinion that chronic dilatation of the duodenum was present before operation in both cases (2 and 3). In Case 2, the condition became acute after operation. There is no evidence that the pyloroplasty was a factor in its production, and there is every reason to believe that this pyloroplasty did not and could not relieve the original condition. In Case 3, the exploratory laparotomy had no effect whatever on the clinical picture. In this third case, the stomach was washed out two and three times a day; this procedure may have prevented acute dilatation, but it had no curative effect upon the chronic condition.



FIG. 166.—ACUTE DILATATION OF STOMACH AND DUODENUM AFTER A FINNEY GASTRODUODENOSTOMY. (Bloodgood.)

The transverse colon cut away. Note relation of mesenteric vessels to position of obstruction.

“Theoretically, posterior gastrojejunostomy with a short loop may have been indicated in both cases. This procedure would have relieved gastric stasis, but might have increased the duodenal dilatation. Theoretically, also, a second anastomosis between the duodenum and the jejunum would have to be performed to drain both duodenum and stomach. Future experience may demonstrate that in cases of this character a simple duodenojejunostomy is indicated. This operation, as far as I know, has never been done, or even suggested before. It certainly meets the indications better than gastro-enterostomy and is simpler than a combined gastro-enterostomy and duodeno-jejunostomy.

“In all three cases, the small intestines were collapsed, with absolute constipation in the first case, but some movement of the bowels in the other two

cases. In none of these cases can it positively be said that the small intestines were in the pelvis. In the two cases which I observed at operation (1 and 3), the majority of the small intestines were not in the pelvis. Free fluid in the peritoneal cavity was absent in all, and there were no adhesions and no gross anatomical lesions to explain obstruction at the mesentery. Nor was I able to ascertain whether the dilatation of the stomach was primary or secondary."

Codman³ early expressed the belief that partial obstruction by the root of the mesentery would explain many cases of indigestion, nervous dyspepsia, etc. He believes the mesenteric artery is responsible for duodenal stasis. The duodenum is distended mainly by gas which leaks through the pylorus into the stomach, causing eructations.

Stavely⁴ quotes Codman as follows:

"People vary greatly in their discomfort in ordinary digestion, even though digestion be perfectly completed. The extreme cases without physical signs are called nervous dyspepsia and hyperchlorhydria. Perhaps such cases may suffer from duodenal distention and their duodenal peristalsis may be constantly overtaxed, because they happen to have more pressure at the root of the mesentery than other people. In such cases the distention is mainly with gas, which occasionally leaks through the pylorus into the stomach, causing eructations. In other cases, however, the fluid contents may flood the first portion of the duodenum and cause more or less acute distress. It is in cases of this sort that lack of exercise and outdoor life play an important part. In other words, a more unrestricted life allows the mesentery to move about more and relax its pressure."

L. F. Barker⁵ was one of the early students of this subject and was the first to suggest duodenojejunoscopy for relief of chronic dilatation of the duodenum, thus preceding Bloodgood by one year. However, Albert L. Stavely was the first to perform duodenojejunoscopy for chronic dilated duodenum in December, 1907. Stavely was an early and intelligent student of this subject. He mentions the diagnostic value of position. He thinks that periodical vomiting, described by von Leyden, characterized by attacks coming on at intervals varying from two to several weeks, occurring suddenly, lasting from a few hours to two weeks, and ceasing suddenly, may be due to arteriomesenteric ileus. There is nausea, vomiting of mucus and bile, gastric pain and headache. Nothing is retained and the patient becomes very feeble. Examination of the stomach contents shows nothing. Stavely also refers to the cyclic vomiting of children as follows:

"Take the cyclic vomiting of children: These attacks come on suddenly in health and are quite similar to those just described. Prodromal symptoms

³ *Boston Med. and Surg. Journ.*, 68:503.

⁴ *Surg., Gynec. and Obst.*, 11:288.

⁵ *Johns Hopkins Hosp. Bull.*, January, 1906.

are usually present, headache, lassitude, loss of appetite, and coated tongue. A slight elevation of temperature is frequently noticed. The abdomen is described as flat and pain is not usually present. Constipation is common and the stools are often white. Thirst is a distressing symptom. The vomitus contains frothy mucus and serum and sometimes blood. According to common description, bile is not found. These attacks have been variously explained as due to a neurosis, faulty digestion, and toxemia."

The following treatment for chronic duodenal obstruction is suggested by Stavely:

"In the chronic, relief may be obtained by vomiting the food ingested; but the continuation of the process favors starvation. Washing out the stomach is not feasible for the same reason. Presumably posture might be serviceable. Having the patient assume such a position as would relax the traction on the mesenteric ligament should relieve the symptoms for the time; and I believe posture, too, would be of benefit in some of these cases of gastric ptoses where angulation takes place in the duodenum. Leaning forward, as one would do in bending over a chair, would increase the angle between the spine and the mesentery and modify the amount of pressure. This has been referred to by Codman."

It is very interesting to note that that strange, but tireless and effective, scientific investigator, Byron Robinson, reports some very careful observations on this subject which give him the rightful place as a pioneer in this field of investigation. According to Stavely, he reports the following case of chronic duodenal ileus:

"In 1895, Drs. Furth and Henry, of Ohio, brought me a patient, who had scarcely kept anything on her stomach for eighteen or twenty months or more. She was emaciated and I could detect only a distended or dilated stomach. The gastropptosis is easily detected; for after the stomach is washed out, it is pumped full of air and this method easily demonstrates its outline. I thought this patient had a stricture of the pylorus and possibly a carcinoma; but she did not lost flesh nor pale sufficiently for malignancy. On opening the abdomen all we found was an enormous gastroduodenal dilatation, which extended to the pelvic brim. Finding nothing palpably pathologic in the pylorus, I performed a gastrojejunostomy with my segmented rubber plates. She made a good recovery and wrote me four years after the operation that she was perfectly well."

Robinson in this early period reported two other cases. The first was seen at autopsy in which he found an extensive gastroduodenal distention with marked distal dislocation of the stomach. The woman had vomited for a couple of years before her death, which appeared to be from marasmus. Death was thought to be undoubtedly the result of malassimilation, due to

disturbance in her system caused by extensive gastroduodenal dilatation. In the second case there was no positive information about the duration of the illness; but it was unquestionably chronic. A man, forty-five years of age, had been in bed five months with hip-joint disease. He had some lordosis. There was great abdominal distention and the vomiting was continuous. Thinking there was obstruction, he operated and, finding an enormously dilated stomach, he closed the abdomen. The patient subsequently died and at the autopsy he found a typical gastromesenteric ileus. He believed the prolonged confinement in bed made the progress of the dilatation rapid in its course.

Stavely's summary of cases of chronic gastromesenteric ileus is as follows:

"We have reports of 11 cases, all subjected to operation or 'postmortem' examination. Seven are positively identified as gastroduodenal dilatations. The rest are designated as gastric dilatations and cannot definitely be proved on account of insufficient data; but there is little question as to their character. In 5, there was reported the curious intermission or remission in symptoms, which is so difficult to explain. Seven cases died of the condition. Four of these had submitted to operation. Two of the operations were exploratory and nothing further was done on account of the uncertainty as to the proper procedure. One had a pyloroplasty, which was undertaken through a mistake in diagnosis and of course was of no benefit, and the fourth had a gastro-enterostomy which was unsuccessful. There were three cures, one of Robinson's treated by gastro-enterostomy, one of Scott's by anterior gastro-enterostomy and one of mine by duodenojejunosomy. The remaining case, the second reported by me, is still under observation. She has improved in regard to some of the symptoms since the operation—cholecystectomy; but those of ileus still persist. If the condition becomes worse and the patient consents, a duodenojejunosomy will be suggested. In conclusion we must bear in mind that chronic gastromesenteric ileus is a distinct condition, which must be seriously considered by the physician and the surgeon, that it may be found to be the cause of much ill health and some deaths; that many gastric conditions, which are now differently interpreted, may be found to be dependent on it and that a better knowledge along these lines will result in mitigating the suffering of or bringing relief to many unfortunates."

Probably the clearest picture or conception of arteriomesenteric ileus yet published is found in Wilkie's article printed in the *British Journal of Surgery*, October, 1921. In this article he relates 4 cases in detail which so admirably fit into each other that the subject is made perfectly clear, and in presenting these cases as the foundation for a clinical conception, he has without doubt established this condition as a definite pathological entity. It seems that he has been studying the subject for a number of years. He was first struck by the presence, in a certain proportion of a series of several hundred cadavers in the postmortem room, of a chronic dilatation of the first three parts of the duodenum, and that this dilatation stopped suddenly at the superior

mesenteric vessels. Most of the patients had died of some other disease. Wilkie had also conducted experimental work on closing duodenal loops which showed how toxic duodenal contents were. These observations, taken with his experience with acute gastromesenteric ileus, caused him to raise the following questions:

"1. Does a chronic obstruction of the duodenum from mesenteric compression never occur?

"2. If it does occur, does it give rise to no recognizable clinical picture?

"3. May it not be the precursor of the acute postoperative condition?"

The fact that acute dilatation of the stomach had occurred a number of times in his experience, in cases where the pathology had nothing to do with the gastro-intestinal tract, caused him to believe these questions might be answered in the affirmative.

The first link in the chain of evidence to prove this was in the following case which he relates.

"Case 1. Female, age sixty-three; admitted to hospital with the diagnosis of 'acute intestinal obstruction.' The patient was so ill that a detailed history could not be obtained, and, as she lived by herself and had no intimate friends, the following facts were all that could be obtained. For years, she had been troubled with her stomach and suffered from chronic constipation. For the past three weeks the trouble had been aggravated, and she had vomited daily and had kept no food down. For the past week, vomiting had been constant, day and night, and for four days there had been no action of the bowels or passage of flatus, in spite of enemata. The vomitus had been for the most part green and bilious; latterly, however, it had been darker in color.

"On examination, patient looked very ill, with sunken eyes, dry tongue, a subnormal temperature, and a small thready pulse, rate 140. She was emaciated. The abdomen was tumid and tense; on palpation, splashing was readily elicited in the umbilical and hypogastric regions. No tumor was palpable anywhere. Immediate operation was undertaken.

"**Operation.**—The abdomen was opened in the midline in the umbilical region. An enormously distended stomach was found filling almost the whole abdomen. A stomach tube was passed and eight and one half pints of dark bilious fluid were drawn off. As the stomach receded, it was seen that the duodenum was greatly dilated in its first two parts, and, on lifting up the transverse colon, the third part of the duodenum was seen bulging forward, greatly dilated, and distended up to the point at which it was crossed by the mesenteric vessels. Beyond this, the intestine was collapsed. On pulling up the loops of small intestine, which were all lying in the pelvis, they were seen to be empty, but congested, and to be studded with small ecchymoses. (The cause of the latter was found to be pressure on the superior mesenteric vein by the greatly dilated third part of the duodenum,

which had bulged over the accompanying vessels, and also almost certainly to pressure from the great weight of the dilated stomach.) A posterior gastro-enterostomy was performed. In spite of the administration of large quantities of saline intraperitoneally and subcutaneously, the patient never rallied, and died twelve hours after the operation.

"At postmortem, the operative findings were confirmed. The great dilatation of the duodenum was found to end abruptly at the crossing of the superior mesenteric artery. There was no evidence of any acute infective process anywhere which might have caused an acute toxic dilatation of the stomach."

This case settled in Wilkie's mind that chronic duodenal obstruction did occur and was of clinical importance.

In the second case, which follows, he was convinced that the usually rapid death following duodenal perforation was due in a large measure to the retained duodenal contents which he had found so poisonous experimentally:

"Case 2. Male, age thirty-seven, had suffered for some nine months from indigestion. For three days before the onset of perforation he had been out of sorts and said to be suffering from gastric catarrh. At midnight on April 2, 1920, whilst in bed, he was suddenly seized with very severe abdominal pain. When seen by the doctor at 7 A.M. he was found in a state of collapse and was sent to hospital. On admission, at 11 A.M., patient was in a state of intense shock and was obviously moribund. He could not stand a general anesthetic, but, under local anesthesia, an attempt was made to close the perforation. On opening the abdomen a very great quantity of bile-stained exudate escaped. He died on the table, however, within twelve hours of the original perforation.

"The question arose as to why this well-developed man should have succumbed so quickly to a perforation of no great size, coming on, as it did, whilst he was on low diet and under treatment for so-called gastric catarrh.

"At postmortem, the first, second, and third parts of the duodenum up to the root of the mesentery were found very markedly dilated, the mucosa being intensely congested, in striking contrast to the pale mucosa beyond. No evidence of disease in other organs was found to account for the rapid collapse after the perforation."

The next piece of evidence was from the following case of death from "vicious circle" after gastro-enterostomy:

"Case 3. Mrs. J. B., age forty-four. Had complained of occasional stomach trouble since the age of thirteen, but had been in fair health until four months before operation. At this time she began to suffer from severe pain in the epigastric region, coming on usually about two hours after food, frequently accompanied by vomiting, which always relieved the pain. She

frequently suffered from great nausea, coming on at irregular times and followed by vomiting, which gave instant relief. Rest in bed and milk diet relieved her symptoms, but a return to more ordinary diet was followed by a recurrence of the pain, nausea and flatulence. After treatment for ten weeks in a medical ward, a surgeon was called in. From the irregularity of the symptoms, and the fact that there was some tenderness in the right iliac and lumbar regions, it was thought that the gastric symptoms might be reflex from the appendix or proximal colon.

"First operation, December 17, 1920.—Through a high gridiron incision, the appendix, which showed little abnormal, was removed, and a very mobile proximal colon was fixed after the method of Waugh.

"Second operation, January 4, 1921.—Epigastric incision. A dilated and hypertrophied stomach and a duodenal ulcer, causing definite stenosis just beyond the pylorus, were exposed. A posterior gastro-enterostomy with a short loop was performed. The patient continued to vomit daily after the operation, for the most part bilious material.

"Third operation, January 21, 1921.—The abdomen was reopened in the epigastric region, and an entero-anastomosis between the two limbs of the loop was performed. It was noted that the proximal loop was not distended as had been expected would be the case. After the third operation she continued to bring up mouthfuls of bilious fluid and gradually became more emaciated, refusing all food. In spite of absorbing large quantities of saline and dextrose per rectum, she gradually sunk, and died five days later.

"At postmortem, a duodenal ulcer causing marked stenosis of the first part of the duodenum was found. Beyond this, the duodenum was greatly dilated up to the crossing of the superior mesenteric artery. The mucosa was engorged and congested. Beyond the root of the mesentery the bowel was pale and empty, and the entero-anastomosis was unavailing, as it was performed two inches beyond the seat of obstruction" (Fig. 167).

The next case was the first in which Wilkie recognized the condition of chronic duodenal obstruction during life and treated it at operation:

"Case 4. Female, age thirty-eight, married, six children. Complained of pain in the epigastrium after food; pain under the right breast, flatulence and vomiting.

Ever since she was a young girl, patient had been bothered with flatulence after meals. Six years ago she had an attack of severe indigestion, accompanied by vomiting, lasting for several weeks. Two years ago she consulted her doctor for pains under the right breast, distention with wind after meals, and vomiting. Her doctor treated her for a sluggish liver, but without improvement. During the last two years she had never been free from pain and flatulence after food, and always had to loosen her clothes after eating. During this time she had several attacks consisting of, first, severe headache, blackness before the eyes; then a feeling of nausea and epigastric discomfort, followed by bilious vomiting, which gave her

relief. She lost twenty-eight pounds in weight during the past two years. For many months her diet consisted of milk, tea and biscuits. If she took more solid food she had within an hour a sensation of distention sometimes almost amounting to bursting in the epigastrium, only relieved by vomiting. After one of the attacks from which she suffered, her friends remarked that she was yellow and hollow-eyed. When she vomited she brought up large quantities of fluid, usually, though not always, yellowish green in color. During the last two attacks of pain and vomiting, she had definite shivering.

"On examination, the patient was thin and hollow-eyed. The abdomen was flat. There was definite tenderness under the right costal margin, and the upper part of the right rectus muscle was rigid.

"Provisional diagnosis, gall-stone in common duct.



FIG. 167.—DUODENAL OBSTRUCTION CAUSING VICIOUS CIRCLE AFTER GASTROENTEROSTOMY FOR DUODENAL ULCER. (Redrawn from Wilkie's superb colored picture published in the *British Journal of Surgery*, October, 1921, p. 207.)

The opening in the jejunum was the lateral anastomosis described in Case 3.

"Operation, February 11, 1920. On opening the abdomen through the right rectus, the gall-bladder was found to be normal in appearance and no gall-stones were present; the common duct was slightly dilated, but no stone could be felt. The stomach was distended with gas; the pylorus was widely dilated, admitting three fingers, and the first part of the duodenum was enormously dilated, resembling a second stomach (Fig. 168). The second half of the duodenum was likewise dilated. On throwing up the transverse colon, the third part of the duodenum, greatly dilated, bulged up into the wound. The dilatation extended to where the superior mesenteric vessels crossed the duodenum; beyond this the duodenum was collapsed and empty (Fig. 169). On passing a finger behind the mesenteric vessels, which were tightly stretched across the duodenum, and raising them, gas immediately escaped onwards into the jejunum.

"The obvious treatment was to anastomose the dilated third part of the duodenum to the jejunum. The peritoneum of the posterior abdominal wall over the duodenum was incised, the third part mobilized, and an angled Brunner's clamp applied. The jejunum seven inches from the duodenojejunal juncture was likewise clamped, and a lateral anastomosis performed. Interrupted linen sutures were used for the outer layers, and continuous catgut for the inner layers. When the anastomosis was completed, the parietal peritoneum was fixed to the duodenum by one linen suture.



FIG. 168.—GREAT DILATATION OF FIRST PART OF DUODENUM AND PYLORUS AS SEEN AT OPERATION IN CASE 4. (Wilkie.)

"The patient made an uninterrupted recovery, and within a week after the operation was taking articles of diet which she had not dared to take for years previously. An X-ray photograph taken three weeks after the operation, two hours after a bismuth meal, showed that the duodenojejunal anastomosis was functioning well.

"Ten weeks after the operation, the patient had gained twenty-one pounds in weight, and was feeling and looking very well."

The third case showed connection between a mobile cecum and ascending

colon while the fourth case showed that, by lifting up the mesenteric vessels, the gas in the duodenum passed out.

This last observation of Wilkie corresponds exactly to E. L. Kellogg's⁶ "Pressure Paradox" which he describes as follows:

"In cases showing a dilated duodenum, pressure is made backward and upward for about thirty seconds by the hand placed just below the umbilicus,

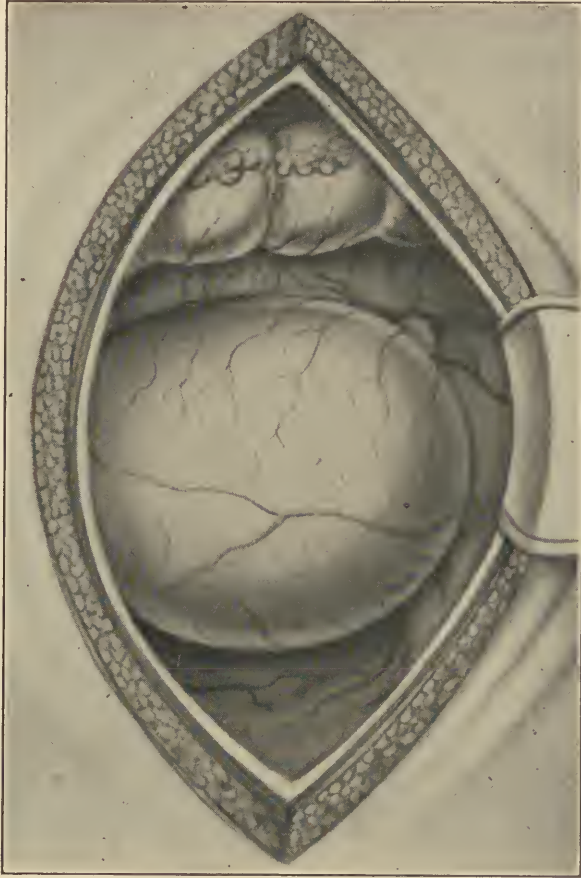


FIG. 169.—DISTENDED THIRD PART OF DUODENUM IN CASE 4, BULGING INTO WOUND WHEN TRANSVERSE COLON WAS THROWN UPWARDS. (Wilkie.)

the patient being in a semirecumbent or reclining position. It might be thought that this would increase the amount of gas present in the duodenum; on the contrary, in the type of case we are considering, it will usually result in the undoing of the duodenojejunal kink, permitting the duodenum to empty itself, as shown by a relatively dull percussion note or marked diminution in the size of the tympanitic area. At the same time it is often possible to hear and feel the gas escape as it rushes into the jejunum."

⁶ *Surg., Gynec. and Obst.*, 28:174.

After relating his experience, Wilkie gives his concrete clinical conception of chronic dilatation of the duodenum or chronic arteriomesenteric ileus as follows:

"Pathological Anatomy. The salient feature of the condition is the dilatation of the first three parts of the duodenum up to the crossing of the mesenteric vessels. The dilatation is most pronounced in the first part of the duodenum, which may look like a second stomach. The dilatation of this part may, however, be masked or modified by the presence of the scar of a duodenal ulcer. In three of my cases a duodenal ulcer was present; in another, a gastric ulcer. The wall of the duodenum is hypertrophied, the degree varying in different cases. In one of my cases it resembled the wall of the stomach when grasped between the finger and thumb. The pylorus is usually dilated; in one case it admitted three fingers. This is not invariable, however, and the maintenance of the tonicity of the pylorus may modify the clinical picture, as will be indicated later.

"The small intestines will, as a rule, be found empty and lying in the true pelvis. On drawing up the small intestines by pulling on the mesentery, a feeling of resistance is encountered and the intestines will sometimes leave the pelvis with a 'pop.' In other cases it is the cecum and lower part of the ascending colon which occupy the true pelvis and offer resistance when an upward pull is applied to the mesentery. If the duodenum is distended at the time of examination, and a finger be passed behind the root of the mesentery and the latter lifted forwards, the duodenal content will immediately pass on and fill up the duodenojejunal loop.

"Symptomatology. The patient is usually a female of somewhat spare build and of a visceroptotic type. She gives a history of stomach trouble for many years, usually since childhood. She will state that she has always had to be careful of what she ate, otherwise she suffered from epigastric pain and flatulence. Periodically she has had 'bilious attacks,' with nausea and vomiting. At the age of thirty or thereabouts the symptoms become aggravated. Epigastric discomfort and flatulence follow all but the simplest of meals. Walking and standing aggravate these symptoms; rest in bed gives a certain amount of relief. Some patients will volunteer that they have found that lying on the face or in the genupectoral position will give relief. In addition to the chronic flatulent dyspepsia so suggestive of a biliary condition, they suffer from what they term their 'attacks.' These are the typical popular 'bilious attacks' consisting of, first, a day of headache and nausea and epigastric discomfort, sometimes amounting to actual pain; this is followed by vomiting, first clear, then bilious. This may last for a whole day, after which the patient feels completely relieved, although relatives remark that she looks hollow-eyed and has a tinge of jaundice. Such attacks tend to recur at intervals of from four to five weeks, and are ushered in by constipation. In a few cases the nausea, headache, lassitude, and epigastric pain are the most pronounced symptoms, and vomiting is an occasional and late symptom. In such cases it would appear that a tonic pylorus resists the

duodenal tension until at last it gives way, bile regurgitates, is vomited, and relief is obtained. The persistence of such symptoms over a prolonged period is apt to lead to a state bordering on, if not actually of, neurasthenia, when the subjective symptoms complained of multiply by analysis and make diagnosis more difficult.

"Physical Signs. In a pronounced case, examination of the abdomen may reveal a definite epigastric fullness. This, however, usually will not be detectable. When asked to indicate the site where pain is felt, the patient will refer to a point about one inch above the umbilicus, and usually slightly to the left of the midline. At this area some superficial cutaneous hyperesthesia may be detected. In some cases the seat of pain is located to the right of the midline. Pressure by the examining hand from below upwards tends to relieve the pain. Should the duodenum be distended with gas at the time of examination, a definite tympanitic swelling may be made out above the colon. This I have seen in one case, but it must certainly be unusual. Succussion will show the stomach to be dilated. Duodenal succussion I have never elicited."

The most extensive clinical experience with surgical treatment on record has been published by E. L. Kellogg and William A. Kellogg.⁷ The article by Kellogg is very exhaustive. In it the principal work connected with the subject has been abstracted and a complete bibliography of all that had been written on the subject is appended.

In this article he relates his experience with 41 cases treated by duodenojejunostomy. The résumé of his case reports follows:

"Total number, 41. First duodenojejunostomy performed in 1915. Males, 16; females, 25. Ages, ten to twenty, 2; twenty to thirty, 12; thirty to forty, 15; forty to fifty, 8; fifty to sixty, 3; not stated, 1.

"Previous operations were performed in 22 cases: Gastro-enterostomy alone, 5; gastro-enterostomy and appendectomy, 3; appendectomy alone, 5; appendectomy and nephropexy, 2; appendectomy and cholecystectomy, 2; hysterectomy and cholecystostomy, 1; hysterectomy alone, 2; tubal pregnancy alone, 1; laparotomy, nature not stated, 1.

"Symptoms have been grouped as follows: Headache, 27; regurgitation, 25; eructations, 30; borborygmus, 25; heartburn, 13; loss of weight, 35; constipation, 38; vomiting, 22; vomiting of bile, 19; vicious circle, 4; bilious attacks (constipation, headache and vomiting of bile), 9; pain, 34; localized in the epigastrium, 29; right hypochondrium, 7; at the duodenojejunal junction, 6; in the back, 9. The pain was definitely related to food in 11 cases. Dull in character in 11, sharp in 13, coliclike in 6. The gastric acidity was normal in 7, low in 9, high in 17 and not stated in 8. Impaired motor function and bile found in the fasting stomach was noted in 23 cases.

"X-ray report, correct diagnosis 18 in 33 examinations, ulcer wrongly diagnosed in 9 cases.

⁷ *Ann. Surg.*, May, 1921.

"Pathology. The stomach was dilated in 10 cases, ptosed in 3, and an ulcer found in 1. The duodenum showed an ulcer in 2 cases, was moderately dilated in 10, considerably in 11, greatly in 7, and not stated in 3. The cecum was dilated in 15 cases, prolapsed in 10. Adhesions were about it in 4, and in 3 there was a Jackson membrane. The hepatic flexure showed adhesions or prolapse in 7 cases. Chronic appendicitis was found in 4 cases. The small intestines were in the pelvis in 4, the jejunum was angulated or adherent in 11.

"The indications for which duodenojejunostomy was performed were as follows: 3 cases, 1 suggestive of gall-stones, the other 2 of chronic appendicitis, in which a dilated duodenum was found; 1 in which ulcer was suspected or diagnosed, but in which the pathology was a dilated duodenum, or adhesions about it; 3 cases, 2 with a duodenal ulcer and 1 with a gastric ulcer as well as a duodenal dilatation. In these a gastro-enterostomy was also performed, 4 with vicious circle, 4 complaining of continued epigastric pain and vomiting of bile, after a previous gastro-enterostomy had been performed by various surgeons and in which a dilated duodenum was demonstrated; 14 with epigastric pain, vomiting, or typical bilious attacks in which a dilated duodenum was suspected or diagnosed before operation. Four of these also showed ulcer of the duodenum. Of the 41 cases operated upon, 31 have been followed up to a recent date, and are so completely relieved of their symptoms that it is justified to classify them as cured; 5 cases were apparently cured at the time of their leaving the hospital, but we have been unable to get a subsequent report; 4 cases have been greatly improved, but still complain of some troublesome symptoms; 1 case feels that there has been no benefit from the operation.

"The results convince us that duodenojejunostomy will save from invalidism a group of patients not amenable to other treatment, and should be recognized as a definite surgical procedure with well-defined indications and limitations."

Kellogg's detailed case reports in this article are very interesting.

The clinical picture of chronic duodenal obstruction as seen by Kellogg is as follows:

"Symptoms.—For a clearer understanding, the cases may be grouped in accordance with the anatomical and symptomatic variations.

"Anatomical Grouping. First. The asthenic duodenum: The symptoms are latent or toxic. X-ray examinations may show delay and puddling of bismuth in the duodenum, with sluggish peristalsis and slight or no dilatation.

"Second. Duodenal obstruction with incompetent pylorus. Bile regurgitates easily into the stomach, dilatation is moderate or absent.

"Third. Obstruction with hypertrophy (the writhing duodenum). The duodenum is elongated and its walls are thickened. Under the fluoroscope it is seen to labor over its contents. The pylorus functionates and little or no bile regurgitates; cramplike pains are the predominant symptom.

"Fourth. Dilated duodenum. The area of duodenal tympany is increased. Pain is usually present either steady and dull, or cramplike. This is the type most frequently recognized by the roentgenologist.

"Symptomatic Grouping. First, latent; second, toxic; third, mechanical; fourth, toxic and mechanical.

"Latent obstruction may exist without diagnostic symptoms, the condition being recognized at operation or by X-ray examination.

"The Toxic Symptoms.—Laboratory studies of duodenal toxicity, after ligation of the jejunum, have been made by Maury, McLean and Andries, Whipple, Stein and Bernheim. Experimental animals die in a few days with weak pulse, low blood-pressure, subnormal temperature and diminished secretion of urine. The last authors have shown that the cause of death is a chemical and not a bacterial poison.

"In human beings we find these symptoms, together with the characteristic vomiting or regurgitation, in acute gastrosenteric ileus, in certain cases of vicious circle after gastro-enterostomy, and in the terminal stages of chronic duodenal obstruction.

"The usual toxic symptoms are less severe, however, such as vomiting, headache, neuralgia, mental and physical depression, disturbed heart action, cold extremities, hyperesthesia, paresthesia, skin eruptions and neurasthenia.

"The Mechanical Symptoms.—These vary with the mechanism of the attacks. When obstruction involves the first portion only, the symptoms are those of partial pyloric obstruction. Harris has made a study of this group and states that it is a chronic condition with remissions. His patients complained of distress or pressure in the epigastrium sometimes becoming a sharp pain, recurring two or three hours after meals and relieved by food. With this there is epigastric tenderness and excessive secretion of hydrochloric acid. If compression takes place in the region of the ampulla of Vater, we may have papillary stenosis, as pointed out by Anders and Campiche, with deep chronic jaundice, acholic stools, enlarged and sensitive liver. In my experience, this is accompanied with pain referred to the right costal arch.

"In all obstructions below the ampulla of Vater, the symptoms may be grouped together, except for pain at the duodenojejunal junction, which seems to be peculiar to constriction at that point. If due to prolapse of the intestines, there may be periods of comfort when the bowels are functioning properly, but with constipation the drag of the distended bowel inaugurates an attack. This is probably the mechanism of so-called bilious attacks characterized by constipation, headache, and vomiting of bile.

"The condition of the pylorus will modify the symptoms, for with a resistant pylorus, pain is prominent, while with a relaxed one, regurgitation or vomiting of bile occurs without pain. Two areas of discomfort are observed, a pain or dull ache at the left of the median line, slightly higher than the navel (the duodenojejunal junction), relieved by deep pressure, and a pain above and at the right of the navel, extending under the liver and to the shoulders. This may be coliclike, due to peristaltic unrest, or steady and

dull, due to distention and often lasting until relieved by vomiting. Occasionally pain is limited to the back and is referred to the midline between the shoulder-blades. It may be of an intense boring character. Following an attack of pain the patient may feel something give (apparently the resisting pylorus yielding to pressure), the pain subsides and vomiting or regurgitation of bile follows. Frequently patients obtain relief from deep pressure in the median line of the abdomen below the navel (presumably by unlocking the duodenojejunal kink). Attacks of pain may simulate biliary colic or duodenal ulcer or chronic appendicitis, and in operating for these conditions with negative findings, duodenal obstruction should be looked for. In the majority of the cases there will be a combination of both toxic and mechanical symptoms.

"In contrast with the above, pain is usually absent in acute gastromesenteric ileus, or, if present in the beginning, disappears with the progress of dilatation. This, with the absence of fever, accounts for the frequent failure to diagnose the condition.

"Treatment.—A minority of the cases are surgical from the beginning, notably those having a hugely dilated duodenum, or continuous and copious regurgitation of bile into the stomach.

"In the greater number, the dilatation is less marked, but they have attacks of pain, or bile regurgitation, or toxic symptoms with intervals of comfort between the attacks, the symptoms often not pointing clearly to the duodenum. For these cases, medical treatment should always be tried and it is usually successful. It consists of abdominal support, sleeping with foot of bed elevated, resting after meals, postural treatment, abdominal massage and exercises, lavage, duodenal and colonic irrigations, mineral oil, cathartics, rest cure and overfeeding.

"When not successful, surgery is indicated. The procedure may be directed to the duodenum itself, or to some other part, the pathology of which is a factor in producing obstruction, frequently to both. The following operative procedures have been recommended: jejunostomy, resection of duodenum and reuniting anterior to mesenteric vessels, approximation of recti muscles, gastro-enterostomy, suturing the jejunum to under surface of transverse mesocolon, dividing adhesions with readjustment of duodenum, shortening the gastrohepatic omentum (Beyea), enlarging the mesenteric opening, stretching or dividing the ligament of Trietz, cholecystogastrotomy, or enterostomy (for papillary stenosis), suspending the transverse colon (Coffey), plication and fixation of cecum and ascending colon, with restoration of hepatic flexure, resection of cecum and ascending colon, cholecystectomy (to prevent gall-bladder adhesions from reforming), duodenojejunostomy.

"The choice of procedure will be determined by the subjective symptoms and mechanical conditions. In obstruction of first portion, dividing adhesions, the Beyea or Coffey operations or gastro-enterostomy; of the second portion, the same, or cholecystectomy or duodenoduodenostomy; of the third portion, some procedure to relieve the intestinal drag, Coffey operation,

resection or plication and fixation of cecum and ascending colon, duodeno-jejunosomy."

I believe Kellogg has given the clearest demonstration of the technic of duodenojejunosomy yet published. Therefore, we will give the description of the operation in his words:

"The operation is similar to gastro-enterostomy, but there are some practical points worth emphasizing (Figs. 170, 171, 172, 173).



FIG. 170.—DUODENOJEJUNOSTOMY. (E. L. Kellogg and W. A. Kellogg.)

The duodenum is exposed by an incision extending downward and inward. A large blood-vessel presents at the lower angle of the incision and may be easily injured. It should be represented in the peritoneal layer instead of behind it.

"Incision.—Upper right rectus or transverse if there is reason to anticipate the encountering of adhesions from previous operation. The dependent portion of the duodenum is located retroperitoneally, below the transverse colon, in close relation to the hepatic flexure. The peritoneum is incised obliquely downward and inward and the opening enlarged sufficiently to give a satisfactory exposure. Large blood-vessels will present at the inner angle.

"The duodenum is freed by blunt dissection behind the descending and transverse portions. Free mobilization adds to the ease of the subsequent procedure. The duodenum is drawn forward and the edge of the mesenteric opening is sutured to it posteriorly.

"The dependent portion of the duodenum and the superior surface of the

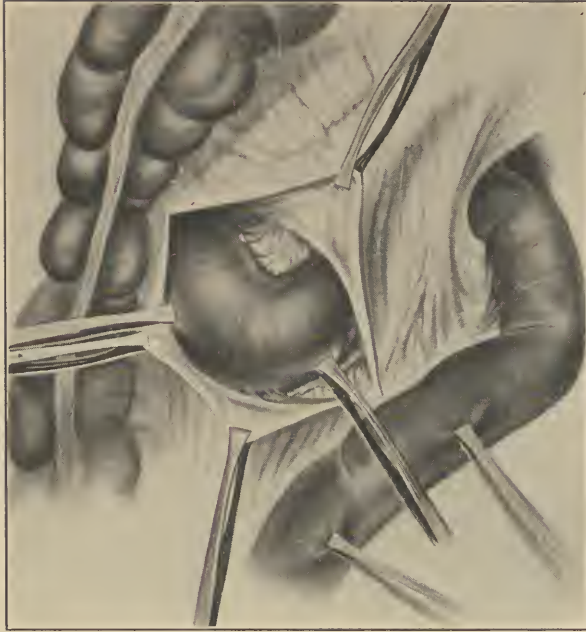


FIG. 171.—DUODENOJEJUNOSTOMY. (E. L. Kellogg and W. A. Kellogg.)

Allis' forceps are applied on the duodenum and jejunum to mark the points of the anastomosis.



FIG. 172.—DUODENOJEJUNOSTOMY. (E. L. Kellogg and W. A. Kellogg.)

The duodenum has been lifted from its bed after blunt dissection behind the second and third portions. Stitches are inserted for closing the peritoneal opening posteriorly. They pass through the peritoneal edge from without inward so as to invert the raw surface.

jejunum are approximated and held with traction stitches. A continuous suture of fine linen softened with vaselin is inserted, a gastro-enterostomy clamp is applied, and a one and one half inch incision is made in the duodenum and a slightly shorter one in the jejunum. The suturing is then completed as in gastro-enterostomy, particular attention being given to the angle stitches. In completing the outer anterior stitch, the approximation must usually be made entirely at the expense of the jejunum. This may be facilitated by inserting the jejunal stitch at right angles to the incision and the duodenal stitch parallel with it. The opening in the mesentery is closed anteriorly by suturing to the duodenum. The procedure is more difficult than gastro-enterostomy, but postoperative experience leads to the conclusion that the mortality is lower and complications are less apt to occur."

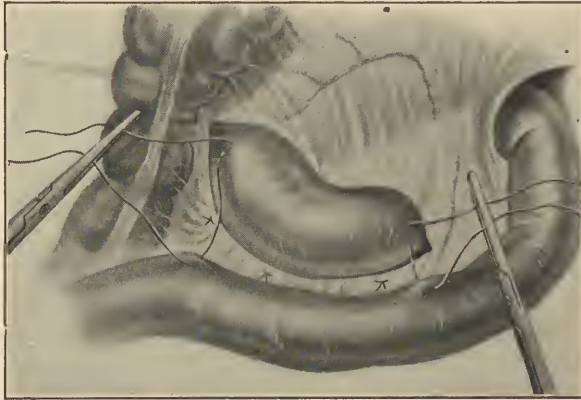


FIG. 173.—DUODENOJEJUNOSTOMY. (E. L. Kellogg and W. A. Kellogg.)

Posterior peritoneal sutures are tied and traction stitches are inserted between the duodenum and jejunum. On the jejunal side they are close to the mesenteric border, so that the jejunal incision will be on the superior surface instead of the free border. These sutures aid in the manipulation of the duodenum, which tends to retract, and also prevent angulation at the point of anastomosis.

If anything further is to be added to the technic of this operation, it would be in the line of discarding the clamps. However, it must be conceded that Kellogg's results are practically perfect.

In his final conclusion he states,

"The total number of duodenojejunostomies reported are fifty-eight. There has been no mortality."

Gregoire⁸ describes a new technic for duodenojejunostomy, setting forth certain principles which are of interest. The following is a translation and abstract made by W. A. Brennan.⁹

"The transverse mesocolon and the root of the mesentery from the two sides of an angle, the opening of which contains the end of the second and

⁸ *Surg., Gynec. and Obst.*, September, 1922, 192.

⁹ *International Abstract of Surgery*, September, 1922.

the beginning of the third portion of the duodenum. This is the operative field of duodenojejunosomy. When this angle is a right angle, the operative field is very large, but when it is acute, the field is greatly restricted. The peritoneum here is mobile and this mobility becomes a hindrance to the performance of duodenojejunosomy.

"When the operative angle is large, laterolateral duodenojejunosomy is indicated because the mesocolic surface of the duodenum is large. The first jejunal loop is selected. The loop should not be turned to make the peristalsis of the two loops occur in the same direction. During the suturing, the duodenum is occluded by the fingers of the assistant who compresses its second portion against the left flank or the lumbar spine.

"The technic of laterolateral duodenojejunosomy is exactly the same as that of any other laterolateral anastomosis, but there are two points which merit special attention, namely, the danger of injuring the superior mesenteric vein, and the difficulty caused by the mobility of the peritoneum in front of the duodenum. In placing the seroseros buried sutures, care should be taken not to insert the needle too deeply so as to penetrate the musculature of the duodenum.

"When the operative angle is acute, laterolateral anastomosis is almost impossible. This fact led Gregoire to try the Y-anastomosis on the cadaver. Duval has had the opportunity since to use it in a clinical case. However narrow the operative angle or short the accessible portion of the duodenum, it will always be possible to make the terminal discharge of the jejunum at the lowest point. The risks of the Y-anastomosis are not much greater than those of lateral anastomosis, but the operation takes longer. A duodenojejunosomy so executed when the laterolateral is impossible assures perfect drainage at the lowest point and avoids all danger of vicious circle."

I believe the authors I have just quoted have given us such a clear picture that we can now proceed with the clinical application in our everyday practice.

In order to further elucidate this subject from my own personal experience, I wish to give a stenographic report of two cases operated in my clinic within the last few months:

CASE I. One operation was performed October 28, 1922. No. 23470, Mrs. W. W. This patient is a female, thirty years of age; married very young; has had three children. She has had an interesting past from the standpoint of surgery. I believe it was in 1916 that she had both of her ovaries removed for some reason; in 1917, her appendix was removed; in 1918, she was operated on for adhesions; in 1919, she was again operated on for adhesions; in 1920, she was operated on for some stomach trouble; in August, same year, she had some repair work done; in 1921, she had a gastro-enterostomy; in 1921, she went to a very distinguished surgeon in the east and, after a thorough investigation, he did an exploratory operation. From a letter written to her physician which was forwarded to me, I find

that when he opened her abdomen he found postoperative adhesions at the site of the abdominal operation and numerous adhesions about the pylorus, which he thought might have been caused by sutures placed there for the purpose of narrowing the pylorus at the time the gastro-enterostomy had been done. The gastro-enterostomy opening seemed to be working perfectly. At this time, the surgeon found that the gall-bladder was buried in adhesions and that there were no gall-stones present. He believed the adhesions were not due to gall-bladder. He separated the adhesions and explored all the abdomen but did not find any other disease. He found the uterus was hanging by a band from the abdominal wall; that the ovaries and tubes were missing. In this letter from the surgeon to the patient's physician, it was stated that she would probably not be well until she reached the age when she would naturally go through the change of life.

When I first examined this patient, I was very much inclined to take the same view and told the patient that I had very little hope of being able to do anything for her. I have often remarked that I have rarely seen a patient whose ovaries were removed before she was thirty who was not a wreck before she was forty, and I stated to the patient that my sentiments were the same as those of the eastern surgeon whose judgment I rely upon as being superlatively good. But when Mr. Trahar's X-ray report came in, a markedly dilated duodenum with decided duodenal stasis was revealed. I have, therefore, told her that in the light of the fact that she has so many local gastric symptoms and vomits most of her food since, as well as before, the operation; belches gas all the time and bloats up frequently; is losing weight and is not benefited by the psychic effect of her recent exploratory operation, I believe we are justified in another exploration on the grounds that, despite her neurasthenic tendencies, she has a widely dilated duodenum manifested chiefly in its second and third portions.

We open the abdomen through the right rectus muscle and find moderate adhesions, particularly around the duodenum and gall-bladder; the omentum is adherent to the abdominal wall but is quite easily separated. On drawing the middle of the transverse colon out through the wound, I bring the anastomosis into view. The jejunal loop has been fairly long. There is a constricting mass of adhesions around the jejunum between the gastro-enterostomy and the origin of the jejunum. Above this, the jejunum is somewhat dilated. On pushing in the anterior stomach wall from above, I am able to pass two fingers through the anastomosis, so that I know it is functioning perfectly. There are no adhesions obstructing the jejunum below the anastomosis. The cause of the vomiting of bile does not appear in connection with the anastomosis. On lifting up the first half of the transverse colon and looking below it, I find a very widely dilated duodenum which comes into view below the mesocolon. I feel very sure that this will account for her distress and constant vomiting. I am therefore going to do a duodeno-jejunosomy. We split the mesentery or peritoneum over the duodenum and pull it forward with Allis' forceps. I find that it is at least twice normal size; that its walls are exceptionally thick, showing that they have been

overdeveloped in the effort to overcome an obstruction. In this case, I am able to use clamps on the two intestines and we will do the anastomosis just as we would do a gastro-enterostomy.¹⁰

Postoperative.—The postoperative course of this case was unusually smooth. The patient was never nauseated after the operation and began to take food on the second day and to gain rapidly before she left the hospital, three weeks after the operation. She never had a single symptom referable to the stomach after the operation was performed.

One by one we have gradually lessened that group of cases which we can legitimately class under the head of "neurasthenia." There are plenty of them left and this patient is probably one of them, but we must always bear in mind the fact that the anatomy of a neurasthenic is much the same as a normal individual, and the result of a distorted anatomy or perverted physiology will in these patients manifest much the same symptoms as in normal individuals. In her case we shall await later results with interest.

CASE 2. In the report of my clinic for December 2, I find the following case which is also very interesting: No. 23700, Mr. C. J. T. This patient is a clergyman, thirty-five years of age. For ten years has had attacks of indigestion and biliousness; has pains in the pit of the stomach from one-half to two and one-half hours after eating; feels a great deal of tenderness all through the epigastrium; has attacks of pain with vomiting of quantities of bile; belches very little gas but bloats after eating. For the last two weeks he has had pain through the right side of the rib arch, soreness under shoulder. He has been losing weight—losing about twenty pounds last year. Badly constipated.

This case bids fair to tangle me up in my former statements, in which I said that I have never known a case of peptic ulcer in which achylia existed. Yet we have here a case in which there is a twelve-hour stasis, practically all barium still in stomach for twelve hours. The X-ray picture shows a slight deformity which looks as if it might be a duodenal ulcer, but he has an achylia which, according to our statements to you in the past, means that, if he has an ulcer, it must be syphilitic or malignant. Wassermann is negative and the patient is almost too young for malignancy of the stomach (except in rare instances). Therefore, we are confronted with the possibility of an ulcer or the scar of a peptic ulcer in which an achylia exists. If this is true, it is the first one I have ever seen and completely upsets our entire theory as to perpetuation of an ulcer. If we find that this is an ulcer, I shall still believe that the specimens of gastric contents must have been mixed in the laboratory.

On opening the abdomen, we find a white scar just outside the pylorus. In fact, it is right in the pylorus, possibly a healed ulcer. I don't quite understand that. I find concretions in the appendix. Will remove the

¹⁰ This is E. L. Kellogg's technic and was described in the *Annals of Surgery*, May, 1921, 73:578.

appendix. There is a band which seems to be an acquired band and there is a certain amount of ptosis. Below the scar, which we thought was an old ulcer scar, I note that the second portion of the duodenum is dilated. This may be one of those duodenal stasis cases of which Wilkie has been saying so much lately—chronic duodenal arteriomesenteric ileus. I turn up the transverse colon and look beneath. See those acquired bands running along the superior mesenteric vessels. These have evidently been laid down in response to a strain on the mesentery. The duodenum is enormously dilated.

Student.—"What do you do in such a case?"

We shall do a duodenojejunostomy instead of a gastro-enterostomy. See what a tremendous duodenum this is. A peculiar thing about this type of case is that Wilkie has found a number of these cases in which an ulcer of the duodenum was found just outside the pylorus and, in three cases, he has had perforated ulcer just where the scar shows in this case. But you see this patient hasn't an active ulcer. This accounts for the achylia. He seems to have had an ulcer but the question is whether there is a direct connection with this duodenal ileus. We split the transverse mesocolon which covers the duodenum and pull up the colon with Allis' forceps; but find I am unable to use clamps in this case so I tack the peritoneum of the posterior wall of the abdomen to the duodenal mesentery and to the intestine. I see a very dangerous looking vessel there which I must avoid. I will turn the jejunum to the right in a graceful curve from its beginning and place it where it lies easily against the duodenum. I then place a traction loop and attach the proximal portion of the jejunum to the distal portion of the duodenum and, at the other end of the proposed anastomosis, I place another traction loop about two inches away from the first one. I now use a continuous peritoneal suture of linen from one of these loops to the other, because it is a little easier than making interrupted sutures and we are in an alkaline area and, therefore, there is no danger of secondary ulcer. Next I put in a row of interrupted linen suture which penetrates all of the coats. Note how thick the duodenum is in this case. Having placed these two layers of sutures, I cut down to the mucosa of the duodenum and find that, instead of cutting to it, I have cut through the entire thickness of the duodenal wall at one place. There are some duodenal secretions escaping so I enlarge the incision and pack the duodenum temporarily with a long gauze tape sponge. I then make my incision in the jejunum. I begin the suture with a chromic catgut suture on a curved needle and make a lock stitch on the back, just as if I were doing a gastro-enterostomy, and then complete the operation in front just as in a gastro-enterostomy. You will note I have placed back of the anastomosis a pad of gauze to catch the secretions. This I now remove. Now we have completed the duodenojejunostomy. This one has been a little more difficult than others I have performed but, at that, it is more quickly performed than a gastro-enterostomy.

Kellogg has collected the cases of duodenojejunostomy for this condition and found 54 cases without a single death. Included in this list were several

operations by Quain of Bismarck, N. D., and Freeman of Denver and others.

Student.—"Had there been an active ulcer there, would you have done this operation?"

No, I think I would have done a gastro-enterostomy, although it is quite possible that later I would have had to have done this operation also, for I have had two cases in the past year in which I have had definite ulcer and have done a gastro-enterostomy and have later had to do a duodeno-jejunosomy in order to get relief.

Student.—"How common are cases of this kind?"

I do not know. This field is just being opened up. I had a letter from Wilkie of Edinburgh last week and he said he had found a number of them this year, one in a boy seven years old. Now an important question is, Where was this barium that showed twelve-hour stasis? Was it in the duodenum or was it in the stomach? I scarcely see how it could have been held in the stomach for there was no obstruction of the pylorus. It is quite possible, it seems to me, that this stasis might have been in the duodenum and yet it is my understanding that an obstruction of this kind often causes a reverse peristalsis from the duodenum into the stomach and thus produces a stasis in the stomach. You see the duodenum lies just directly back of the pyloric end of the stomach, so it is going to be a tremendously important thing to look this up and see if we can determine whether that residue was in the duodenum or stomach. This is the most thrilling and interesting field that has been opened for a long time and we are indebted to Wilkie of Edinburgh for giving us the best clinical picture of this condition, although it must be said for Bloodgood that he was one of the first, if not the first, to seriously consider chronic duodenal ileus. Stavely of Johns Hopkins was the first to do the operation of duodenojejunosomy.

Postoperative.—This patient made an uninterrupted and complete recovery and has never had the slightest symptoms since his operation.

Believing that this condition may develop very early in life, I wish to include the report of two very interesting cases as a basis for future investigation.

William A. Downes¹¹ reported the following case under the title of "Giant Duodenum":

"B. W., male, age four and one half years. Admitted October 31, 1916, with a history of recurrent vomiting. Weight at birth six pounds—admission weight twenty-nine pounds with clothes. Breast fed for five months. Vomiting almost from birth—at first very small quantities, later larger amounts. Periods of from one to two months without vomiting. As the feedings were changed from fluids to semisolids, the vomiting attacks continued. Vomitus frequently contained food taken from one to three days before; always hungry, and could eat immediately after vomiting. At four months of age had a severe attack of diarrhea with blood and mucus. Sim-

¹¹ *Ann. Surg.*, 66:436.

ilar attacks about every two months. At eighteen months had an attack lasting three weeks, accompanied by high fever and extreme prostration. Last severe attack January, 1916. Marked constipation between diarrheal attacks. Stools foul smelling. Abdomen always distended, especially in epigastric region. Raised great deal of sour-smelling gas.

"Examination. Fairly well-developed, undernourished child, very bright, color good, moderate distention. After taking eight ounces of water, marked peristaltic waves of unusual character were noted in upper abdomen. The movements of the stomach were not of a definite peristaltic character, traveling as do the ordinary cases of pyloric stenosis from left to right, but there was an irregular set of contractions visible sometimes near the cardiac and sometimes near the pyloric end of the stomach. In the region below the pylorus, to the right, there was a very definite peristaltic action—the waves passing from above downward and below upward, usually concentric in character. A large oval contracting mass could be felt in this region, and definite splashing sounds could easily be elicited. Percussion at this time gave a tympanitic note, although later on, when the pouch became filled with fluids, the note was flat. Lavage soon returned clear, to be followed later by bile-stained fluid with old food particles. No effort was made to distend the stomach or duodenum with air, as the X-ray had already given a clue to the diagnosis. Radigram taken by Dr. R. D. Baker showed the following: Fifteen minutes after bismuth meal (Fig. 174) the stomach was seen to be in normal position and of about normal size. Just to the right of the stomach was shown a pouch, extending nearly in a vertical direction and fully the size of the stomach, which was apparently the dilated duodenum. In the second picture, taken two hours later, the stomach had almost emptied itself, but the dilated duodenum remained about the same or was even larger, only a small amount of the bismuth having passed into the jejunum. Picture at twenty-four hours showed bismuth well into the colon, but the duodenal pouch could still be outlined distinctly. A study of these plates with the history and physical signs led to the diagnosis of partial obstruction of the duodenum, probably at the duodenojejunal junction, with saccular dilatation above. The patient was given daily lavage and small doses of atropin three times a day for one week.

"Operation (November 6, 1916), posterior no-loop gastro-enterostomy and closure of pylorus by silk ligature; upper right rectus incision. Stomach appeared normal with possibly a slight thickening of the wall; pylorus normal, easily admitted tip of index finger. Duodenum dilated to the size of the stomach. Wall smooth and three to four times thicker than normal; no diverticula observed. No adhesions or peritoneal bands. The distention involved the entire length of the duodenum, ending abruptly at the point where the gut passed under the superior mesenteric artery. No effort was made to determine the nature of the stenosis or its cause. The jejunum from its very beginning appeared normal in every way. No distention or hypertrophy. There were no adhesions in the region of the fossa of Treitz. No enlarged mesenteric glands. The usual posterior gastro-enterostomy was

performed; double zero chromic catgut used throughout. Complete division of the pylorus was planned as a part of the original operation, but the condition of the child would not permit the carrying out of this step, and we were forced to resort to occlusion by means of a heavy silk ligature. Vomited moderately for twenty-four hours after operation, otherwise convalescence straightforward.

"Discharged, November 23. On mixed diet at this time, eating three meals a day. Condition very good. No distention and no fullness could be felt in region of duodenum. One week after discharge from the hospital, vomiting recurred—first in small quantities, but later in increasing amounts



FIG. 174.—X-RAY PICTURE OF GIANT DUODENUM AND STOMACH OF A CHILD FOUR YEARS OF AGE. (Downes.)

and at one time vomited as much as one and a half quarts. Distention returned and the general condition of the child became much the same as it had been before operation. Readmitted to the hospital December 6, almost in collapse, temperature subnormal and abdomen greatly distended. Lavage brought away a large quantity of undigested food with immediate improvement in the general condition.

"Daily stomach washing and strict dieting failed to give more than temporary relief, the waves reappeared in the right upper quadrant, the temperature remained subnormal and the whole appearance of the child became distinctly worse. It was quite apparent that the pylorus had opened up. Since the improvement had been so marked for the first four weeks follow-

ing temporary closure of the pylorus, complete division of this structure seemed to be indicated, and accordingly this was done on December 19. At this operation it was found that the ligature had cut partially through, and that there was free communication between the stomach and duodenum. The child did well for the first forty-eight hours following the second operation, then began to complain of pain in the epigastric region and at the same time a slowly forming mass could be felt in the right upper quadrant. This mass increased so that on the fourth day it occupied the entire right side of the abdomen. Temperature rose to 104° , and it was thought that peritonitis had developed. The distention in the right side was undoubtedly due to the fact that fluids and gas were accumulating in the duodenum via the gastro-enterostomy opening, and it did not seem possible that the suture line could stand so great a strain. However, on the fifth day, after repeated enemata, gastric lavage and the use of pituitrin, the bowels began to move freely, large quantities of gas passed and the distention along with the mass disappeared. Convalescence from this time, though slow, was without incident. Discharged January 8, 1916.

"For the first few weeks after returning home, weight remained at a standstill, but more recently has begun to gain. Bowels move regularly, appetite good, and no return of vomiting attacks. Has had no distention nor have peristaltic waves been observed since he was discharged from the hospital."

Downes comments on the fact that the patient was entirely relieved after the first operation until the ligature encircling the pylorus cut through and after the second operation was relieved entirely after the cutting off of the pylorus. He assumes that there was sufficient opening to permit of the bile and pancreatic juice going down through the obstruction.

Downes in his closing remarks says,

"I believe that duodenojejunosomy best meets the indications in the giant type of duodenal dilatation, and should have been adopted in the case herewith reported."

F. G. Dubose¹² makes the following report of the case of a very young infant:

"A search of literature finds no recorded case of giant duodenum in an infant. The symptoms in the case reported began when the child was 3 days old, persisting until the eighth week of its life when it was first seen by me. The condition was diagnosed from the physical and X-ray examinations. Downes, of New York, reports a case in a child four and one half years old.

"The clinical course in the infant is similar to pyloric stenosis in its subjective expression, and in its effect in producing rapid emaciation. The differential diagnosis is made by the appearance of bile in the vomitus and in

¹² *Surg., Gynec. and Obst.*, 1919, 29:278.

the absence of a palpable pyloric tumor. In the case here reported, there was a rapid loss of weight, vomiting occurring at irregular intervals without definite relation to food or fluid intake, and after nursing the regurgitated milk returning bile stained, and the subsequent vomitus containing bile and duodenal fluid, in larger amounts than fluids ingested. Through the thin and emaciated abdominal walls of the infant, as in pyloric stenosis, the visible coils of intestines and peristaltic waves were easily observed. Immediately after nursing and before the onset of vomiting, the distended stomach and duodenum could be seen in the epigastrium. The roentgenograms demonstrated the abnormal condition with unusual accuracy and clearness of definition.

"Normal delivery, fourth child, of healthy parentage. Weight at birth seven and one half pounds. She began vomiting yellow fluid the third day. At this time the child was being nursed at two-hour intervals. The interval of nursing was lengthened to four hours without effect. Nursing with the head down and body elevated was tried, but the vomiting continued. Various medicines were prescribed by the attending physician without benefit.

"When first examined by me, November 23, 1918, the child weighed five and one half pounds, showing a loss of two pounds in two months. She was apathetic, took no notice of people or things, never cried. Her eyes had the Mongolian slant. The tongue was larger than normal and slightly protruding. All of these findings and the facial expression were suggestive of cretinism. Vomiting occurred at irregular intervals, either bile-stained milk or duodenal fluid. She was fed a barium meal with a teaspoon, beginning at 11:20 A.M., under such difficulties that it required forty-five minutes to feed two ounces.

"At 12:05 P.M., November 23, 1918, the first X-ray plate was taken, showing a filled stomach, a narrow pylorus, an enormous ovoid duodenum, and some barium in the intestines. Ten minutes later shows the stomach smaller and the duodenum larger with a distinct pylorus. At 12:30 the stomach was almost empty, only a small portion of the barium meal remaining at the cardiac extremity. Fifteen minutes later the stomach was completely empty and the duodenum filled. Some retching occurred but no vomiting in the next fifteen-minute interval, and taken at 1:00 P.M., showed the stomach beginning to refill by regurgitation from the duodenum. Three hours and fifteen minutes were required, as shown in Fig. 174, for the duodenum completely to empty itself into the stomach, which is here shown refilled and distended with the barium meal.

"The globular appearance of the duodenum in the X-ray plates would justify the opinion that there was possibly a diverticulum of the duodenum. The partial occlusion of the duodenum as it appears in the roentgenographs seems to be not the duodenojejunal junction, but cephalad to it in the fourth portion of the duodenum. Operation was advised as the only possible and as a very barely possible means of saving the infant's life. The roentgenograms demonstrated the fact that the obstruction was partial, that it was caudad to the bile and pancreatic ducts. The duration of eight weeks with

a loss of two pounds in body weight was additional confirmation of partial obstruction. These facts made the operator prefer doing a gastro-enterostomy with occlusion of the pylorus as a surgical procedure in this case rather than a duodenojejunosomy, which is without question the operation of choice in complete arteriomesenteric obstruction at the duodenojejunal junction. On November 28, 1918, under ether anesthesia through a median upper abdominal incision, a posterior gastro-enterostomy was done. The pylorus was tied off with a purse-string suture of linen and the gastroduodenal serosa approximated over this with interrupted Lembert sutures. The time consumed in operation was thirty-five minutes. It was observed on opening the abdomen that the duodenum was of enormous size, dilated and flaccid. There was neither diverticulum, constriction, adhesive band, or kink of the duodenum, but the jejunum was collapsed beyond its origin at the mesentery, having an appearance such as is found in mechanical obstruction of the intestines caudad to the point of obstruction. It is probable that in this case we have a true arteriomesenteric obstruction at the duodenojejunal flexure from the superior mesenteric artery overlying it, or from some abnormality in the structure of the mesentery, with a resulting kink at the duodenojejunal junction, and that the megaduodenum was a sequence of this rather than a congenital giant duodenum. The postoperative convalescence was uninterrupted, with immediate cessation of periodic and persisting vomiting."

CHAPTER XV

INTESTINAL STASIS AND RADICAL SURGERY

My admiration of Sir W. Arbuthnot Lane for his vision, accurate observation and courage to promulgate his conviction is unbounded. I believe his proclaiming the evils of intestinal poisoning has been and will be of untold value to humankind. Yet, by the most careful observation and study of my clinical experience, I have been unable to see any convincing proof that such diseases as cancer of the breast, tuberculosis, ulcer and cancer of the stomach are directly caused by bacterial absorption from the alimentary canal. I believe that the harmful effects of stasis are chemical more than bacterial, that the chemical agents absorbed into the blood from the stagnant contents of the bowel have an indirect bearing on disease by lowering the oxygen carrying powers of the blood and otherwise poisoning the vital centers and body tissues, thereby lowering resistance to direct infection.

Importance of the Large Bowel.—Radical surgery, by which the large bowel has been removed, or completely excluded by ileostomy for one purpose or another, has given us positive, definite and final proof that the large bowel is not one of the vital necessities of mankind. It is not essential to the life of the carnivorous animals; it is essential to the life of the herbivorous animal.

An ileostomy wound discharges its contents during a large part of the day, and would greatly handicap its possessor, without a reservoir to hold the discharge until a convenient time for its disposal. A colostomy wound at any point from the distal one third of the transverse colon discharges its contents intermittently from one to three times in twenty-four hours. In the one instance, the discharge is liquid and almost constant; in the other the discharge is by mass movement. In the one instance the discharge is practically odorless; in the other it has an offensive odor. This is due to the fact that the contents of the gastro-intestinal tract, from the stomach to the ileocecal valve, is practically sterile of bacteria in a normal individual. Nearly all of the ingested bacteria are destroyed in the stomach. Bacteria are even very scarce at the terminal ileum but very prolific in the cecum.

In carnivorous animals, the entire large intestine may be emptied by the stimulation of the sacrovisceral nerves; in herbivorous animals, stimulation only empties the distal half of the large intestine and has no influence on the cecum.

The large intestine of a purely herbivorous animal may possibly have an important digestive function. In man, the digestive function of the large

intestine is negligible. Bacterial activity in the cecum is very great. Bacteria in man seem to act more in the capacity of scavengers and the cecum may be likened to a septic tank when functioning properly or a garbage can when not functioning properly. While it is said the cecum absorbs from 50 to 80 per cent of the intake of water, this is by no means an essential function as shown by the fact that the discharge from an ileostomy opening rapidly becomes more concentrated and in the course of a few weeks or months, the small intestine takes up the function of absorption of all the normal water intake. The bacterial growth in the cecum seems to be largely for the decomposition and conversion of vegetable matter into harmless substances so that the residue which is retained in the large intestine until a convenient time for evacuation will do no harm. It is probable that the 50 to 80 per cent of water normally absorbed in the cecum is brought there for the purpose of aiding bacterial life during this decomposition. After it has served its purpose in this capacity, it is absorbed for use of the body. Fluid injected into the rectum is chiefly carried to the cecum for absorption. After removal of the large intestine down to the pelvic colon, the ileum, in the course of a few months, takes up the function of the cecum to such an extent that it is frequently found that a patient who was constipated before is very likely to become constipated after removal of the colon.

It will therefore be seen that the essential function of the large intestine is one of convenience rather than necessity, but that this convenience is very great and it is probable that an individual without a colon and without an ileocecal valve is by no means as well off as one who has a colon and an ileocecal valve. The importance of the ileocecal valve may be expressed by stating that *the ileocecal valve is an effective self-closing gate placed at the threshold of the true digestive apparatus to protect it against emanations from the septic tank or garbage can of the human body.* This gate performs its function perfectly in 80 per cent of individuals, most of the 20 per cent of imperfect functioning being found in patients with habitual constipation or cecal stasis resulting from ptosis.

In considering the advisability of the removal of the colon, we must also take into consideration the fact that the removal of a colon is not a simple matter when considered from the standpoint of mortality or morbidity, the former ranging from five to twenty per cent, depending on the skill of the operator, the latter being equally as serious, for a very large per cent of such cases subsequently have intestinal obstruction or painful adhesions. Therefore, after taking into consideration the mortality, morbidity, pain, expense and inconvenience of the operation, added to the handicap of the absence of an ileocecal valve and a function certainly not as good as that of the original colon, even if it were possible to remove all these handicaps, it seems unwise even to consider such a radical operation except in the most extreme cases for very special indications. I believe that radical surgery for intestinal stasis, which involves the removal or exclusion of the large bowel, has been more important from the standpoint of teaching physiology and pathology than for the establishment of an enduring therapy. However, it is undoubt-

edly true that rare and exceptional cases will occasionally arise which demand some form of radical surgery for intestinal stasis.

It is entirely possible and indeed quite probable, if we are to believe reports emanating from the New Jersey State Hospital for the treatment of insane, that there are certain cases of epileptiform attacks which may be traced directly to intestinal stasis, also certain forms of insanity.

The radical views of Reed of Cincinnati, and what most surgeons believe to be his extravagant¹ claims as to results following intestinal operations for epilepsy, have caused many conservative surgeons to go to the other extreme and refuse entirely to investigate the subject. It is probably true nevertheless that a certain per cent of seeming epileptics and insane patients may be cured by this measure.

Lane's undoubted cures of what appears to have been Raynaud's disease and of Still's disease and other serious joint involvements and even very serious toxemia without local manifestations by removal or short-circuiting of the colon must in the minds of fair-minded surgeons require investigation at least.

In these serious conditions in which, upon careful investigation, the physician or surgeon is convinced that there is a direct relation between obstinate constipation and the otherwise incurable malady which confronts him, it becomes his duty, as a conscientious physician acting in the interest of his patient, to take what seems to be very radical steps rather than permit the patient to remain in this distressing and hopeless condition. Fortunately, the late Dr. John Young Brown of St. Louis suggested a means of determining this without going to extremes. This is determined by producing a temporary ileostomy. Since Brown's popularization of this operation, many hundreds of fistulae of this kind have determined that patients may live in perfect health with such a fistula. The making of such a fistula, combined with irrigation and medication of the excluded colon, should be a perfect test as to the responsibility of the colon for the production of these conditions. If the manifestation persists after the complete elimination of the colon as a functioning organ, it would be the height of folly to subject a patient to the dangers and added discomfort of a radical intestinal operation.

I have used a technic for performing an ileostomy which may easily be performed under local anesthesia. Also a technic for closing such a fistula without the necessity of opening the abdominal cavity a second time in case the ileostomy proves that the colon is not at fault. The ileostomy is made and closed as follows:

A wound about an inch and a half long is made down through the middle of the right rectus muscle about one inch and a half below and two inches to the right of the umbilicus. The cecum is located, a loop of ileum is brought up about twelve inches from the ileocecal valve, and the two limbs of the loop are sutured together by two lines of sutures, one along their mesenteric borders

¹ The word "extravagant" is used advisedly with no reflection on Dr. Reed's veracity but rather to raise the question of the meaning of the word "cure." It has been said that any type of operation on any part of the body will cure a certain percentage of epileptics temporarily.

and one along their free borders (Fig. 175). The loop is placed in the wound, protruding the desired distance, a fine chromic catgut suture is threaded into a small curved needle and is used double as a continuous button-hole suture, by which the peritoneum is fastened around the protruding loop. A similar suture is passed around the loop fastening it to the aponeurosis. Interrupted sutures threaded in a small cutting needle fasten the intestine to the skin (Fig. 176). The gas and fecal contents pass easily around this loop, so that it is not necessary to open it until convenient (Fig. 177). The opening is then made with a cautery, and a Delatour colostomy outfit (Fig. 178) used as a receptacle. I cannot recommend this device too highly. It has not failed in any instance to hold, so that such a thing as spilling and soiling the clothing

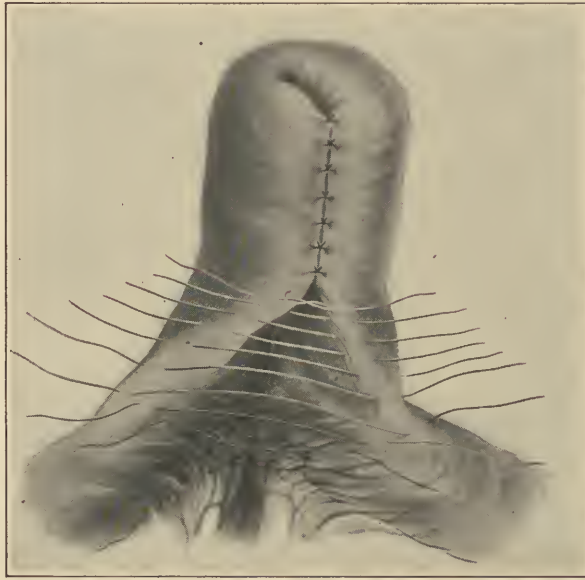


FIG. 175.—SUTURING TOGETHER THE FREE EDGES OF THE INTESTINAL LOOP.

is unknown while the patient is standing. I have a number of such patients performing all of their duties and going to social functions as usual with no discomfort. The apparatus does not work so well when the patient is lying.

After the test as to the toxemia in question has been completed and it has been determined that the intestine is not at fault, it is a very easy matter to close the opening without opening the peritoneal cavity. This operation is done as follows:

A long, thin-bladed clamp is passed down into the two limbs of the loop, as in the Mikulicz operation (Fig. 179). In a few days, by gradually increasing the pressure, the two limbs are cut together. With a cautery the mucous membrane and intestine protruding through the abdominal wall is destroyed down well into the wall, practically to where it leaves the peritoneum (Fig. 180). This operation is somewhat painful, and produces a degree of nausea on account of burning the mesentery.



FIG. 176.—FIXATION OF THE INTESTINAL LOOP OF PERITONEUM, APONEUROSIS AND SKIN BY CHROMIC CATGUT DOUBLED.

Note peritoneal suture, aponeurotic suture and skin suture.



FIG. 177.—SECTIONAL VIEW OF THE FIXED LOOP.

This shows the passage of the intestinal contents through the loop.



FIG. 178.—DELATOUR COLOSTOMY BAG. (Tiemann and Company of New York.)

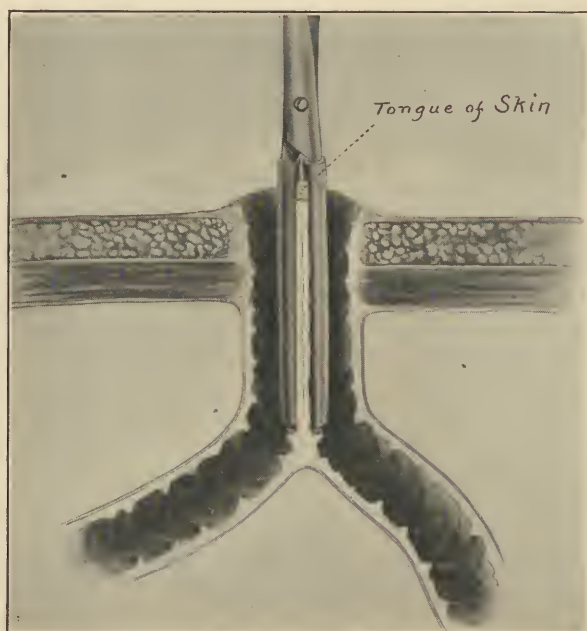


FIG. 179.—GRADUAL DESTRUCTION OF THE SEPTUM BETWEEN TWO LIMBS OF LOOP WITH RUBBER-COVERED CLAMP.

The patient is again allowed to be up, and again wears the Delatour bag, until the sloughing has taken place. In the meantime it is found that the



FIG. 180.—DESTRUCTION OF THE INTESTINAL MUCOUS MEMBRANE WHICH PASSES THROUGH THE INTESTINAL WALL, BY USE OF THE CAUTERY.

intestinal contents are passing on into the large intestine, and it is gradually becoming accustomed to work again.

As soon as the wound has healed in well (Fig. 181), the fistula is closed as follows:



FIG. 181.—INTESTINAL FISTULA AFTER THE CAUTERIZED AREA HAS HEALED.

1. Dissect out the old scar down to the fat, and make an incision around the fistulous tract, including a small strip of skin (Fig. 182), direct the point of the knife slightly away from the fistula so that it first comes in contact with the fascia about half an inch away from the fistula, in order to avoid any

possibility of opening the peritoneum. The incision should extend two inches or more above and below the fistula to allow for wide dissection.

2. Dissect up the fat from the fascia for as much as two inches from the incision, draw it back, and clean off the fascia.

3. Make an incision through the fascia, beginning at the upper end of the wound and coming toward the fistula. Dissect the fascia from the muscle for at least two inches in every direction.

4. Dissect the muscle from the peritoneum in the same manner so that the peritoneum hangs loosely with the fistula standing up in its center, like a volcano and its crater.

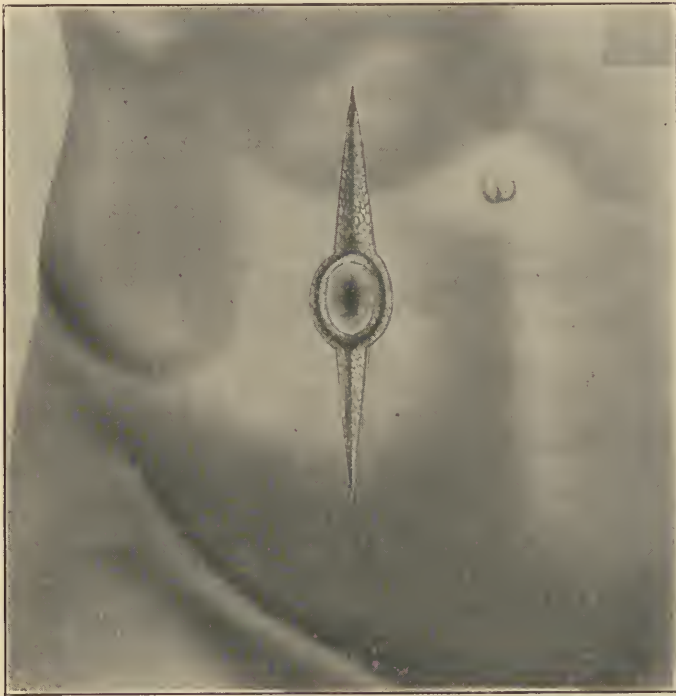


FIG. 182.—INCISION FOR FREEING THE FISTULA FROM THE ABDOMINAL WALL AND SEPARATING THE LAYERS OF THE ABDOMINAL WALL.

5. The little margin of skin which has been left with the edge of the fistula is now trimmed off (Figs. 183, 184).

6. If the wall of the fistula is hard and cicatricial, making it difficult to turn it in, it is well to make an incision part of the way through the cicatricial tissue so that it may be turned in easily.

7. The edges of the intestine are turned in with linen sutures which are knotted on the inside (Fig. 185).

8. A second layer of sutures brings the edges of this incision and the connective tissue over the peritoneum along with the scar tissue, covering the turned-in fistula, to add temporary strength and bulk to the closure. The

peritoneum and the rest of the wound is now thoroughly mopped or irrigated with salt solution to make it as clean as possible.



FIG. 183.—FISTULA FREED, AND LAYERS OF THE ABDOMINAL WALL SEPARATED READY FOR CLOSING.
Direct view.

9. Silkworm sutures are passed through the skin, fat, fascia, and muscle about a half inch or more from the edge, and are left untied, space being left at the upper end of the wound for drainage.



FIG. 184.—SECTIONAL VIEW OF THE FISTULA FREED, AND THE LAYERS OF ABDOMINAL WALL SEPARATED READY FOR CLOSING.
Sagittal section.

10. Suture the muscle loosely with a continuous catgut.
11. Suture the aponeurosis with a strong double catgut.

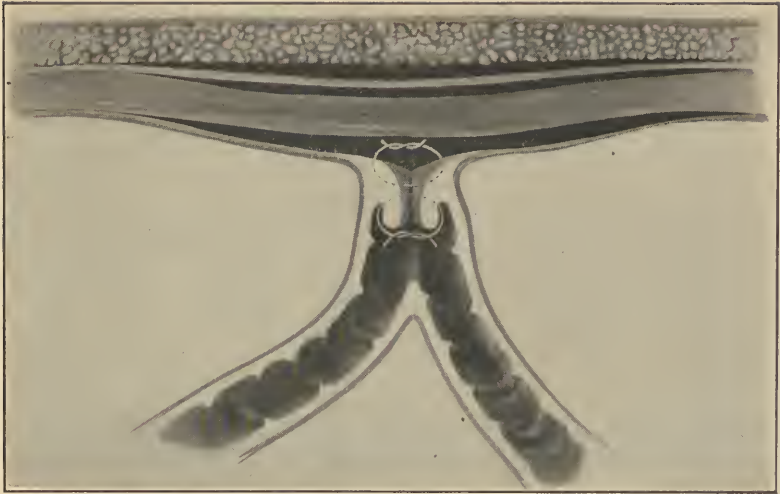


FIG. 185.—CLOSURE OF THE INTESTINAL FISTULA.

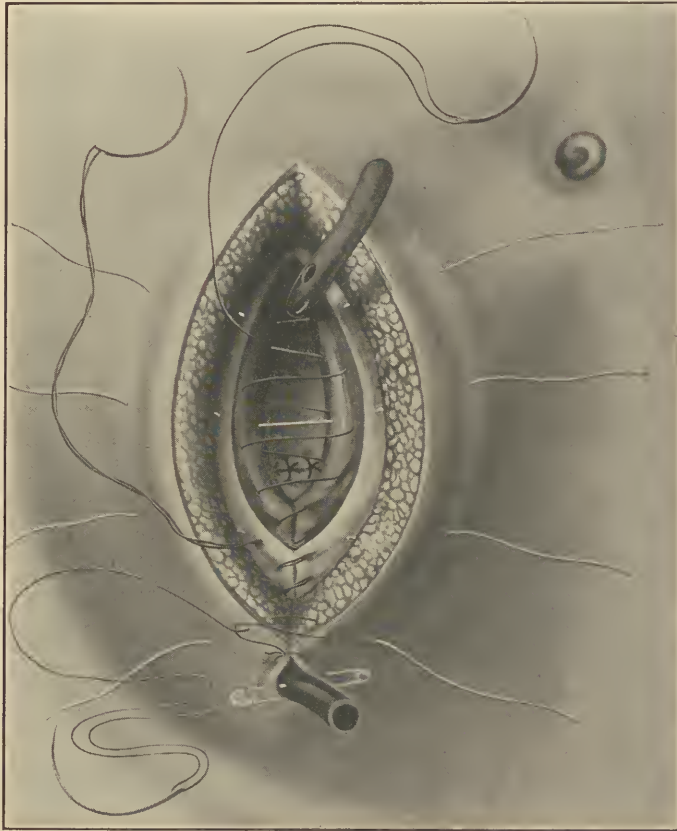


FIG. 186.—CLOSURE OF THE ABDOMINAL WALL.

This shows the closed fistula in the bottom of the wound and drainage tubes at the ends.

12. Suture the skin with a horsehair buttonhole stitch.

13. Place the drains, which may be tubes or cigarette drains, at each end of the wound (Figs. 186, 187, 188).

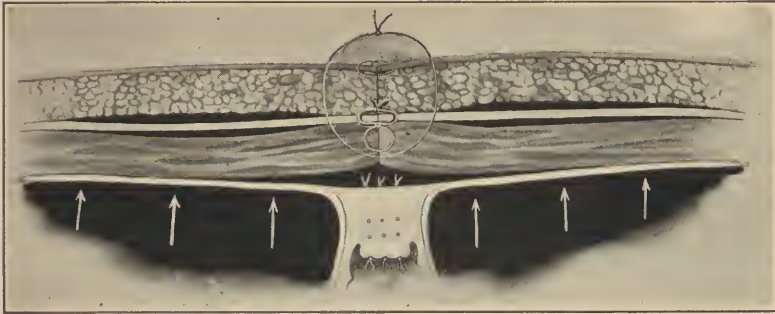


FIG. 187.—CROSS-SECTION SHOWING HOW ALL THE LINES OF SUTURES ARE ENCLOSED IN THE SILKWORM SUTURES.

These obliterate spaces and allow drainage to either side between the layers.

We have never failed to close a fistula of either the large or the small intestine by this means when no obstruction existed below.

By this stage-operation, we make of John Young Brown's ileostomy an operation practically devoid of danger.



FIG. 188.—LONGITUDINAL SECTION OF THE COMPLETED OPERATION. This shows how the spaces drain around the ends of the tubes.

In case the fistula relieves all the symptoms, it is still a question as to whether the patient should be subjected to the danger and morbidity which follows a complete colectomy. It seems that conservatism and the best interests of the patient would suggest that still another conservative step should be taken before going to this extreme. This step was suggested, or at least popularized, by Ochsner. It consists in severing the sigmoid and con-

necting the ileum with the distal segment of the pelvic colon while the proximal segment is brought out through the left rectus muscle. This leaves the patient with two mucous fistulae, but neither is uncomfortable nor seriously inconvenient. I think the study of colectomized patients will show that they have suffered more discomfort than the patients who have the two mucous fistulae.

On the other hand, there may be some cases in which the patient would prefer to take the extra chance of mortality and morbidity and be entirely rid of the fistulae. In such a case, Lane's² technic is probably the best.

"Colectomy.—In this operation the surgeon's chief object is to separate the evolutionary adhesions from the mesentery in the first instance. If

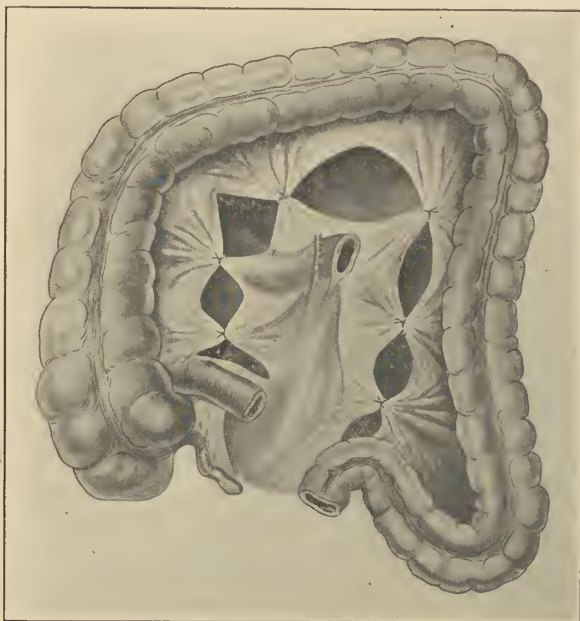


FIG. 189.—DIAGRAM SHOWING THE METHOD OF LIGATURING THE MESENTERY OF THE LARGE BOWEL. (Lane.)

this is done carefully, the outer peritoneal aspects of the mesenteries are left smooth and intact. By doing this, not only is the removal of the bowel greatly facilitated, but little or none of the mesentery is denuded of its peritoneal covering, so that the risk of adhesion to loops of the small intestine is reduced in a manner corresponding to the care that is taken.

"In ligaturing the vessels, the inclusion of large masses of mesentery should be avoided, and subsequently all ligatured points should be rendered as inconspicuous as possible (Fig. 189). It is well to remember that one of the chief immediate risks of the operation is hemorrhage, which may result either from the escape of a vessel from the ligature in a fat subject, or from the friability of the ligatured vessels in a thin toxic one.

² *Brit. Journ. Surg.*, 2:599.

"If the surgeon is unfamiliar with the mode of development and attachments of the evolutionary bands, much difficulty may occasionally be experienced in the removal of the splenic flexure, where these bands are highly developed. This difficulty is probably responsible for the partial resections which are performed by some surgeons, who are satisfied to remove the bowel up to the middle of the transverse colon. I experienced the same difficulty many years ago, and very soon found the futility of this method, since the obstruction afforded by the splenic flexure and last kink militated greatly against the success of the operation. By separating the acquired from the



FIG. 190.—DIAGRAM SHOWING HOW THE ILEUM IS GRASPED BETWEEN TWO PAIRS OF FORCEPS PREPARATORY TO DIVISION. (Lane.)

This is done usually by a cautery.

normal mesenteries, the splenic flexure can be dealt with with great ease and at no risk.

"In colectomy the ileum is divided as in ileocolostomy, usually within a few inches of its termination; but should there be much tuberculous ulceration of the ileum, or adhesion binding it down and obstructing it, more or less of the length of this bowel can be removed with safety (Fig. 190). The surgeon should remember that, while only a small proportion of the length of the small intestine is required for health, the longer the small bowel the greater is the increase in weight of the patient which results from the operation of colectomy. When the patient is stout, the reduction in bulk and the

increase in activity which result from a shortening of the small intestine are a material advantage to the patient.

"The pelvic colon is drawn up out of the pelvis, and grasped with two pairs of forceps about an inch and a half to two inches above the level of the pelvic brim, so affording a sufficient length of pelvic colon to which the end of the ileum can be securely attached (Fig. 191).

"The end of the ileum is attached directly to the cut end of the pelvic colon. The innermost row of sutures perforates all the coats of the bowel, and is of the buttonhole type, while the outer rows secure the peritoneal and



FIG. 191.—THE PELVIC COLON DRAWN UP OUT OF THE PELVIS AND GRASPED BY FORCEPS FOR DIVISION IN A SIMILAR WAY TO FIG. 190. (Lane.)

muscular coats in their grip and do not perforate the lumen of the bowel. It may be most convenient to secure the adjacent aspects of the ileum and colon by a running suture securing the peritoneal and muscular coats (Fig. 192). Then the apertures of the colon and ileum are held apart by means of clip forceps (Fig. 193). The adjacent margins of ileum and colon are sutured by means of a buttonhole suture (Fig. 194), after which the remainder of the circumference is closed (Fig. 195). Fig. 196 indicates the mode of insertion of the continuous seromuscular suture.

"Some difficulty may occasionally be met in effecting the junction because of the difference in caliber of the two portions of bowel; but this can readily be met by arranging the sutures so that each picks up a correspondingly greater portion of the circumference of the pelvic colon than of the ileum.

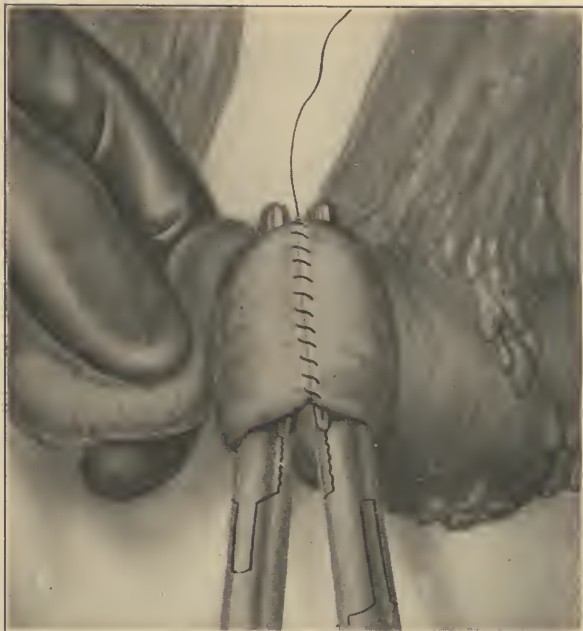


FIG. 192.—THE RUNNING SUTURE SECURING THE PERITONEAL AND MUSCULAR COATS. (Lane.)

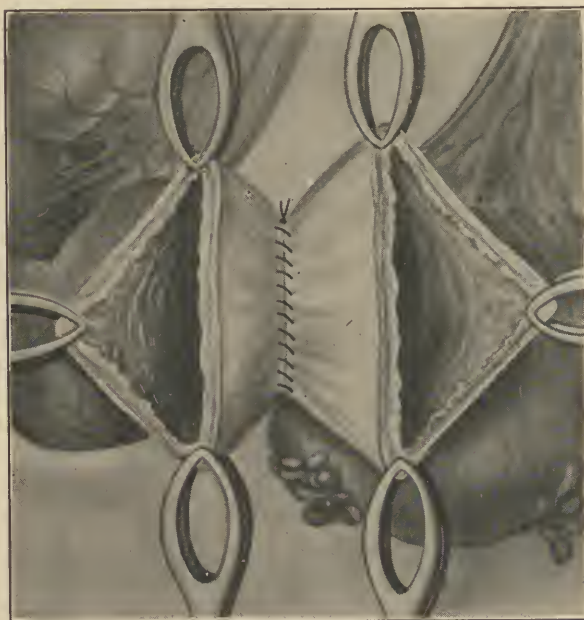


FIG. 193.—THE APERTURES OF THE ILEUM AND COLON HELD APART BY FORCEPS. (Lane.)



FIG. 194.—SUTURE JOINING THE ADJACENT MARGINS OF ILEUM AND COLON. (Lane.)



FIG. 195.—COMPLETION OF THE SUTURE OF THE BOWEL. (Lane.)

Much fat in the peritoneal coat is another obstacle to the formation of a perfectly secure junction, but most of this can be removed before the anastomosis is attempted. Again, a thickening of the walls of the colon and a reduction of its lumen by inflammatory changes which commence in the mucous membrane may render this operation difficult. None of these obstacles are insuperable, and by the exercise of a reasonable amount of skill and patience a perfectly safe junction can invariably be effected.

"After this anastomosis has been rendered complete, the cut edges of the mesentery of the ileum and of the pelvic colon are sutured together, care being taken to leave no raw surface either on the upper or lower aspect of the junction. Fig. 197 shows the manner in which this closure is effected. An esophageal tube is introduced through the rectum and ileocolic junction,



FIG. 196.—METHOD OF INSERTING THE CONTINUOUS SEROMUSCULAR SUTURE. (Lane.)

as described in the operation of ileocolostomy without resection of the large intestine.

"I have not always employed this method of end-to-end anastomosis. In my earlier cases I made use of the method of lateral anastomosis, which was then most generally favored by surgeons. The cut ends of the ileum and pelvic colon were closed, and a large aperture of communication was established between the adjacent aspects of the small and large bowel. The objection to this method was that, however securely the ends of these portions of intestine were fastened down, they both dilated and formed sacs, that which projected from the ileum being considerably larger than that from the pelvic colon. This was not limited to my junctions, since I found that the same occurred in patients of surgeons who, as I knew, were very skillful operators. The accumulation of fecal material, in the ileal *culdesac*

especially, soon becomes a source of great discomfort, and calls for treatment. For a long period I employed an end-to-side anastomosis, closing the pelvic colon and introducing the end of the ileum into an aperture in its side. This was generally very effective. I occasionally came across cases in which obstruction occurred at the junction on the removal of the tube. This obstruction did not always take place at once, but perhaps after a considerable interval; and again, it was not always persistent, but frequently intermittent. It seemed to me that this control of the ileal effluent resulted from some twisting



FIG. 197.—FINAL SUTURE OF THE MESENTERY. (Lane.)

of the bowel at the junction, and in order to obviate its occurrence I employed the end-to-end method. The last has afforded me complete satisfaction, and has freed me from the anxiety associated with the end-to-side junction.”

Ileocolostomy.—I have not mentioned ileocolostomy as a diagnostic measure for two reasons. First, it is much more dangerous than ileostomy; second, owing to the tendency of return of fecal contents to the cecum in these constipated patients, it would not be a fair diagnostic test in that it would not determine the relation between a given disease and the colon.

As a therapeutic measure for intestinal stasis, I feel that ileocolostomy

is not a good operation. It has been tried extensively and, in the hands of most operators, it has not been a success. A patient is usually benefited for a few months, gradually reverse peristalsis takes place, returning the feces into the cecum. In addition to this, the absence of the ileocecal valve causes the ileum to take up the function of the cecum with a return of the intestinal stasis.

J. Rilus Eastman and others at one time advocated cecosigmoidostomy with the idea that the ileocecal valve would thus be saved. This was not successful for the reason that a vicious circle was established and the feces would make a circle around the large intestine following the direction of normal peristalsis.

This was exemplified by a case which came to me for treatment more than seven years ago. Three years before coming to me, the patient had been subjected to the operation of cecosigmoidostomy for constipation. She had not been improved by the operation. X-ray showed there was a perfect circle and no evidence of obstruction. The patient, however, was suffering from a decided intestinal toxemia. I turned her over to Dr. Sears for medical treatment. He treated her for several months but could never make much headway. Finally he returned her to me for a surgical operation of some kind. X-ray pictures seemed to indicate that the

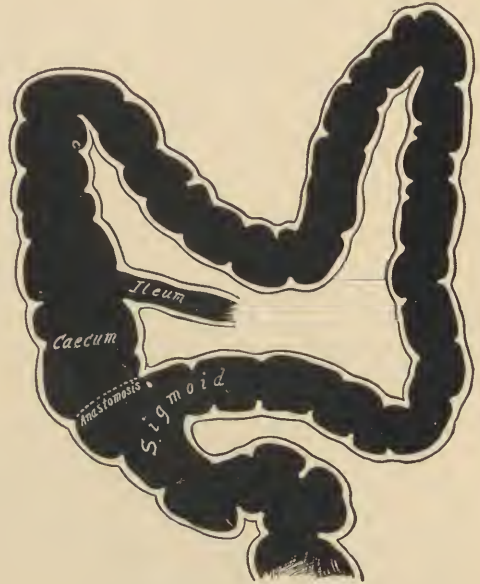


FIG. 198.—VICIOUS CIRCLE FOLLOWING CECOSIGMOIDOSTOMY FOR CONSTIPATION.

fecal contents would come down through the ileocecal valve, around through the ascending, transverse and descending colon into the sigmoid from the sigmoid back into the cecum, and thus a vicious circle was formed (Fig. 198).

I opened the abdomen, not knowing just what operation would be done. It was found that the ascending colon was very much dilated as was also the anastomotic opening and neighboring sigmoid. I then decided to remove the ascending colon and the first half of the transverse colon. With a purse-string we turned in the distal end of the transverse colon and turned in the cut end of the ascending colon, leaving practically no ascending colon above the ileocecal valve (Fig. 199).

This was the first time we supplemented a cecosigmoidostomy with removal of the ascending and part of the transverse colon. This operation was done more than six years ago and the patient has been entirely well since.

It is quite probable that, if other patients who have had cecosigmoidostomy performed upon them could have this operation performed, they would be

cured or very greatly improved. It occurs to me that if any radical operation is absolutely required for intestinal stasis, cecosigmoidostomy with the removal of the ascending and first half of the transverse colon should be the



FIG. 199.—CORRECTION OF VICIOUS CIRCLE BY REMOVAL OF THE ASCENDING AND TRANSVERSE COLON.

operation of choice. The operation is easy, the ileocecal valve is preserved, and in the two cases of mine, at least, the operation has been a complete success.

CHAPTER XVI

MEDICAL TREATMENT OF PTOSIS

Ptosis is a perverted anatomical condition and not a disease. Medical treatment of ptosis is a paradox in that no medicine is used.

Concurrent and sequential diseases, such as disorders of metabolism or renal function, myocardial changes or vascular diseases, psychoses or psychasthenic states, we must leave to the trained internist.

Our problem as surgeons in the treatment of ptosis *per se* is to supply physical and mechanical materials and agents to compensate for the congenital defects and sequential changes. The foremost material or agent in this connection is *fat*.

The Rôle of Fat.—Fat is nature's padding or filler. In youth, it is used near the surface to fill out irregularities and to produce symmetry and beauty. In late middle life along with deficient exercise and oxidation comes the deposit of excess of fat, which stretches the skin and connective tissues. With later life comes absorption of fat along with the degeneration of other tissues, and the overstretched skin and connective tissue of middle life falls in wrinkles and produces the picture of the aged. Likewise, in the abdomen of the young healthy child or adult, all the space not needed for perfectly functioning digestive and eliminative organs is occupied by fat. This fat is deposited under low pressure in the loose extraperitoneal connective tissue. It thereby produces that degree of intra-abdominal pressure which nature deems normal and at the same time makes tense and shortens the extraperitoneal connective tissue meshes. As a consequence, the mesenteries are thickened and shortened.

With the excess fat of middle life, there is an increase of intra-abdominal fat. This latter increase is to a large extent held in abeyance by the strength of the abdominal wall, and is therefore not in proportion to the increase of extra-abdominal fat. It is possible that, in certain instances, this increase of intra-abdominal fat may to an extent increase intra-abdominal pressure, but it seems more likely that most of the increase of intra-abdominal fat is compensated by a decrease of the lumina of the hollow viscera.

In case of rapid and extensive loss of flesh, there is a diminution of intra-abdominal fat (although probably not in proportion to the loss of extra-abdominal fat). Intra-abdominal pressure is correspondingly lowered until the lumina of the hollow viscera have increased sufficiently to occupy the extra space and to establish a pressure equilibrium. Great loss of intra-abdominal fat and a corresponding reduction of intra-abdominal pressure is

often followed by such a stretching of the elastic visceral walls by gas that the power of the muscular walls becomes seriously impaired, the fibers stretched and thinned and peristalsis diminished. Digestion and elimination is correspondingly impaired. The gastro-intestinal tract is said to be in an atonic condition and a general toxemia ensues with dilatation and stagnation of fluids in the organs and ducts emptying into the gastro-intestinal tract. At the same time, the mesenteries are thinned and elongated while the psoas outlet is enlarged, which results in the organs occupying a lowered position conducive to angulation and stagnation. In the past, the ills of these patients have been maltreated under the name of "neurasthenia." In this connection, it is interesting to note that these ptotic, neurasthenic, irritable, undernourished women are much healthier during pregnancy than at any other time. Also that during the childbearing period, healthy young women gradually increase in weight with each new baby. May it not be true that some of this increase in flesh is an effort of nature to compensate for the sudden reduction of intra-abdominal pressure after the uterus has been emptied?

With this conception, fat becomes the *sine qua non* of the nonsurgical treatment of ptosis.

Most of the details of medical treatment are included in the technic of the placing and distribution of fat. It is a curious fact that the first systematic and successful treatment of the ills of ptotic patients under the misnomer "neurasthenia" was devised and carried out nearly a half century ago by S. Weir Mitchell of Philadelphia who was probably the leading neurologist of his day. The principal feature of his treatment was bowel regulation, forced feeding and fattening, with the patient in the recumbent posture during the process. He laid great stress on keeping the patient in a quiet room without visitors. Being a neurologist, he believed that the nervous and neurasthenic manifestations indicated that the condition was a primary disease of the nervous system; that the good effects of the fat were due to the padding of the nerves with a cushion of fat. It is said of Weir Mitchell that much of his success in the treatment of nervous diseases was due to his overwhelming personality and his ability to control his patients by his personality.

In an experience with a large number of patients who have been treated by forced feeding, the importance of this quality has become very apparent.

In the mild cases in which the digestive function has not been seriously altered and in which peristalsis and bowel action are normal, fattening is a very simple matter. By simple increase in the amount of cream, bread, butter, fats and carbohydrates generally, the patient with very little effort will put on fat rapidly, but in the cases which actually need the fat, the problem is far more complicated. These patients are already troubled with gas distention and deficient peristalsis with toxic stagnation of the secretions in the bowels as well as the organs and ducts emptying their secretions into the bowels. Furthermore, they have usually acquired an invalid habit which causes them to localize and identify every pain or distressing symptom. Such patients are usually constipated and believe (for they have been so instructed) that it

is absolutely essential for the bowels to act every day. They have therefore been taking all kinds of cathartics and nostrums of one kind or another. Such patients usually start out very glibly for a day or two. After they have gone two days or more without a bowel action and have been instructed that under no circumstances is a cathartic or enema to be administered, they usually become alarmed and distressed and from past experience conclude that the bowels will never act under such circumstances. The increase in quantity of food and decomposition gradually creates a very uncomfortable state, even after the bowels are acting normally. During the second week the patient often reaches that stage of discomfort at which relief seems imperative and cessation of food essential. If the patient is at home or among sympathetic friends or in a hospital with ordinary care, the patient will usually desist and finally give it up altogether as a hopeless undertaking.

Great eloquence of persuasion and driving force of character combined with a knowledge and experience in dealing with this class of patients becomes essential on the part of the attendant. A nurse possessing these qualities becomes a desideratum of prime importance. Such a nurse is rarely available except in an institution specially equipped and so these patients become essentially hospital patients.

The steps in the process are (1) absolute rest in bed; (2) cessation of all cathartics or enemata; (3) regulation of the bowel by paraffin oil, agar and a large proportion of vegetables to furnish bulky food.

In cases having inert torpid bowels, bran and buttermilk have a good effect. It may be administered as follows: A heaping tablespoonful of bran is placed in a dish, boiling water is poured over it and poured off immediately. It is then eaten with eight or ten ounces of buttermilk.

In those cases having an irritable or painful bowel, bran and coarse vegetables of all kinds are contra-indicated. In these cases vegetables are puréed.

In addition to regulation of the bowel, the next essential is the persistent use of the hot pack which is applied immediately after meals as follows:

Articles necessary:

- 1 ordinary towel.
- 1 bath towel.
- 1 hot water bag (rubber).
- 1 piece of oiled silk a little larger than surface of water bag.
- 2 thicknesses of gauze size of oiled silk.

Apply gauze over abdomen, oiled silk over gauze, then a hot moist towel folded (four thicknesses); next on top of which place a very hot water bag and cover with bath towel.

It is usually necessary to apply the heat sufficient to produce irritation to the point just preceding blister and the heat should be applied for one or two hours after each meal.

It is very essential to keep count of the calories taken for, aside from the scientific importance of this, it is necessary to have a record of the calories

for use in the argument with the patient setting forth the necessity for eating more. Each patient is a separate problem in the line of diet and much ingenuity and diplomatic skill is often necessary to keep a patient going on a diet sufficiently rich in calories to produce the required amount of fat. Generally speaking, such articles of diet as milk, cream, eggs (used cautiously), cereals, bread, potatoes and a great variety of vegetables constitute the staples usually found most satisfactory in the production of fat. In addition to these, it will often be found necessary to apply a wide range in variety of enticing articles of food.

At the end of about two weeks, it is well to have the patient get up and be weighed. After this, the amount of gain should be carefully noted and used as an argument with the patient.

As the patient approaches the desired amount of fat, exercises are begun, most important of which is walking, which should begin with a short distance, gradually increasing as rapidly as possible without interfering with the increase in weight. In addition to walking, exercises for strengthening the abdominal wall and procuring a normal erect posture, such as related in Chapter XI by Dr. Martin. Under certain circumstances, exercises should be supplemented by massage. This, however, usually is not necessary. These exercises not only develop the muscles of the abdominal wall and body generally, but they fix and solidify the fat. It is often very difficult to get these patients to retain the fat unless it has been fixed before they leave the disciplinary care of the hospital.

This, in general, is a successful technic. As before stated, however, there are many cases which do not respond to this routine treatment. One of these is the narrowed upper abdomen with slanting ribs and narrowed chest which goes with long-standing ptosis. In many of these cases, it is necessary to change the shape of the entire abdomen. We have stated the method of doing this in another chapter by surgical means, expanding the upper abdomen and contracting the lower. This is rarely necessary unless there are other reasons for doing surgical work. The upper abdomen can be very largely expanded by postural treatment.

In addition to those procedures mentioned by Martin, very effective aids in expanding the upper abdomen are as follows:

A roll under the middle of the back for a certain length of time during each day.

The knee-chest position for an hour or more after each meal.

Placing the patient's head and chest on a pillow resting on the floor, while the thighs and hips remain on the bed.

By combination of similar procedures, along with strengthening exercises for the lower abdomen, and postural exercises for the reestablishment of the normal psoas or kidney shelf, it is often possible to expand the upper abdomen several inches.

As before stated, there is another class of cases in which it is very important, in fact essential, that attention be paid to the physics of the abdominal cavity. I refer to duodenal arteriomesenteric ileus. In certain cases, it may



FIG. 200A.—ROENTGENOGRAM ILLUSTRATING A PROLAPSED, DILATED, ATONIC STOMACH.

This is the case of a young woman who had been a bed invalid for several months. Weight sixty-two pounds on admission.



FIG. 200B.—ROENTGENOGRAM OF SAME STOMACH SHOWN IN FIG. 200A. (Courtesy of Dr. Sears, who directed the treatment.)

This was taken two months after forced feeding had been completed and shows the small, tonic stomach with normal peristaltic waves. Patient restored to perfect health by forced feeding treatment.

be impossible for the patient to eat and digest the required amount of food; bilious vomiting may take place; great distress in the upper abdomen is noted after meals. When a condition of this kind arises, it is very important to determine whether this distress is due to traction on the superior mesenteric artery. By placing the patient in the knee-chest position, which is maintained by bending over a large roll in bed, or by the more extreme position of putting the patient's head and chest on the floor, while the hips remain on the bed, a patient afflicted with this trouble is usually completely relieved, for it allows a mobile cecum or small intestine to fall out of the pelvis and release the traction on the mesenteric vessels, which in turn permits the duodenum to empty on time. In such a case, of course, it is evident that it is essential to keep the patient in this position as much of the day as is necessary to bring about perfect and comfortable digestion. This position in such cases supplies the double purpose of helping permanently to expand the abdomen and temporarily to permit the emptying of the duodenum. As the patient grows fatter in this condition, the mesenteries grow shorter, the psoas outlet, being naturally only one third the size of the abdomen four inches higher up, probably narrows proportionately more rapidly and makes the psoas shelves broader. It is also probable that the retroperitoneal fat in the neighborhood of the crossing of the duodenum by the superior mesenteric artery may help to hold the artery forward and to solidify it in its position. At any rate these patients usually get relief.

It is probable that fully 75 per cent of ptosis patients may be satisfactorily relieved and made fairly comfortable by this simple process of deposition of fat, application of postural treatment, exercises, bandages, etc., plus proper regulation of the bowel without cathartics. We have a great many cases that have been relieved and made perfectly comfortable by this means. The mechanism of the internal effects wrought by the treatment may be illustrated by X-ray pictures in Figs. 200A and 200B, which is only one illustration in a great many similar cases. Of the other 25 per cent, probably three fifths of the cases can be made very comfortable by a skilled internist. It is probable that about 10 per cent of the cases applying for treatment will require a surgical procedure in addition to these measures in order to give the patient the greatest degree of comfort. In the foregoing chapters, we have set forth the different surgical procedures which may be applied to meet the different indications arising.

CHAPTER XVII

GENERAL INDICATIONS FOR SURGICAL TREATMENT

The most pertinent question a reader may ask concerning a book of this title appearing as one of a group of surgical monographs is, What are the indications for and what patients should receive surgical treatment?

If it were possible by magic to eliminate operative mortality, postoperative morbidity and other inconveniences, I would unhesitatingly say the great majority of cases should be operated upon. Unfortunately, this is not true. There is an operative mortality, although this is small. Besides the mortality, there are many inconveniences and discomforts connected with an operation of any kind involving the opening of the peritoneal cavity.

To one holding Lane's views, all of these patients would be better off without a colon, if the colon could be removed by magic without mortality or postoperative morbidity. I cannot subscribe to this belief, even if it were possible to produce an ileocecal valve by magic also. I cannot believe that any animal which has no fixed portions of its alimentary canal is at all fitted for the upright position. If we had no fixed portions of our intestinal canal to sustain the weight of the residue which must be retained for a considerable time at least, I have no doubt that our intestines would mass themselves in the bottom of the abdomen and that our abdomen would soon assume the shape of the kangaroo. I have no doubt that if a dog were compelled to stand on end for half the time, his intestines would soon mass in the bottom of his abdomen, the shape of his abdomen would change entirely and he would probably become unstable nervously and might be classed as a "neurasthenic." I am sure that the large intestine is an important organ, although its function is largely, if not altogether, one of convenience. It is no doubt true that many individuals suffering from intestinal stasis would be better off without a colon if this could be brought about as we have stated, without mortality or morbidity. Unfortunately, this cannot be done. The mortality accompanying the removal of the colon is great.

Draper in the September, 1922, issue of the *American Journal of the Medical Sciences* reports 77 cases of colectomy, 46 partial and 31 total, with a mortality of 12 per cent. I am very sure Draper's mortality is not greater than the average mortality would be in the hands of good general surgeons.

In Chapple's report on the life-history of 50 short-circuited patients by Lane reprinted from the *British Medical Journal*, April, 1911, which probably represents as skillful work as it is possible to do in such cases, postoperative morbidity is very striking. From one to five subsequent operations have been

performed on more than a third of these patients. We have all seen these patients after radical surgery has been performed for stasis, and the morbidity is even greater in the cases performed by other surgeons than these of Lane which have been reported by Chapple. Taking the mortality and morbidity connected with radical surgery, it is my belief that it is rarely justifiable, except in very extreme cases, even if there were no other surgical measures to which we might resort. On the other hand, I believe that all would agree that if it were possible to restore all of the abdominal organs to their normal position with normal fixation by magic, without postoperative mortality or morbidity, it should be done. Unfortunately, this is not true, but it is possible to restore these organs to normal position surgically with a very small mortality and practically no postoperative morbidity.

The accompanying table includes the statistics of Rovsing, a group of Scandinavian surgeons, Waugh and myself. There are 827 cases reported with 18 deaths, a mortality of 2.2 per cent:

	Total	Too Recent to Report Results	Cured	Per Cent	Improved	Per Cent	Fair	Per Cent	No Improvement	Per Cent	No Report	Per Cent	Died	Per Cent
Rovsing.....	163	.....	92	50.6	24	14.7	18	11	21	12.8	.....	.....	8	4.9
Group of Scandinavian Surgeons (Reported by Rovsing).....	93	.....	70	75.2	9	9.6	11	11.8	.....	.....	.....	.....	3	3.2
Coffey.....	363	7	194	64.9	69	23.07	20	6.68	11	3.67	57	.....	5	1.38
Waugh.	208	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2	.96

It is probably true that each of the surgeons would have a good explanation for the death of these patients and might say that the deaths were not due to operation. This would be begging the question for it is quite probable that the patients would not have died at the time they did had it not been for the operation. In my own statistics, I have shown 363 cases in which some form of replacement or restorative operation has been performed. Of these, there were five deaths, mortality of 1.38 per cent. Of the total number, 293 have been traced. Of the 293 traced, 194, 66.2 per cent, claimed to have been cured; 69, 23.6 per cent, have been very markedly improved, by which is meant that the patient still has some complaints which, although troublesome, are not sufficient to require medical attention; 20, 6.8 per cent, have been somewhat improved but still have a great many troubles; 11, or 3.8 per cent, show no improvement. In no report has the patient complained of feeling worse than before the operation. In one instance, a patient died from an obstruction by a band four years after operation, but this band existed and was cut at the time of the first operation, which operation greatly relieved

the patient for the intervening four years. I have heard of one other patient who has had symptoms of intestinal obstruction but who has not been operated upon and feels that it will not be necessary. It will therefore be seen that the morbidity is negligible.

But, even with such a good showing as this and such a relatively low mortality, there is still that small mortality and operative risk and the discomfort going with any abdominal operation which must be taken into consideration before advising a patient to be operated on for gastro-enteroptosis. Therefore, we come to the point of answering our original question, What are the general indications for surgical treatment of gastro-enteroptosis?



FIG. 201.—NORMAL SMALL INTESTINE OF SUBJECT OF HYPERSTHENIC HABITUS. (Mills.)

Compare with following photo. Small intestine generally high in position showing no tendency to massing in the lower abdomen, its loops discrete and of a high degree of tonus, its motility rapid.

If a young individual who is just passing from adolescence to adult life develops a painful condition in the right side of the abdomen which first begins by mild attacks of pain coming on at intervals, which intervals gradually grow shorter until a soreness is almost constantly present, particularly when the pain extends from the right lower quadrant of the abdomen upward and backward toward the region of the kidney and this pain is sufficiently severe to justify a provisional diagnosis of chronic appendicitis, operation should be advised. If the appendix is found not definitely diseased and the cecum and ascending colon is found dilated and mobile, and particularly if the peritoneum is edematous or is being covered by a growing membrane or bands, the case is one of right-sided ptosis. The removal of the appendix

will bring only temporary relief; the attacks will recur and the chain of sequential symptoms and changes usually going with right-sided ptosis will gradually develop. In cases of complete mobility of the cecum, ascending colon along with an unlocated hepatic flexure, membranes as a rule do not develop. The pain and distress resembling appendicitis in this instance is due to gas distention of the cecum, or to an attachment of the appendix near its tip to the parietal peritoneum which makes of the appendix a ligament for support of the mobile colon. Removal of the appendix in such a condition as above noted will often bring temporary relief. Simply to remove a normal appendix and consign the patient to the class of "neurasthenics" is to be condemned but little less than to remove a normal appendix and try to make



FIG. 202.—PHOTO OF WOMAN OF HYPERSTHENIC HABITUS. (Mills.)

Compare with type of small intestine shown in preceding figure. Physical characteristics are great body weight, short deep thorax, very obtuse intercostal angle, long abdomen, relatively narrow pelvis, high degree of visceral tonus and rapid alimentary motility.

believe that it is diseased, for such cases, in the majority of instances, do not get well by the removal of the appendix. They do get well by removal of the appendix plus shortening of the supports of the cecum or some form of skillfully fixing the cecum combined with the supports of the first half of the transverse colon by suturing the omentum to the abdominal wall.

In short, I believe that surgery is justifiable and advisable in all chronic pains in the right side of the abdomen which are of sufficient severity to warrant a diagnosis of an organic lesion, particularly if this pain is discovered in the early developmental or adult life. I am very sure that if these young patients could be discovered and receive proper surgical treatment at this stage, the ptosis question would be very greatly diminished and an untold amount of discomfort and distress could be prevented and the physical efficiency of the

population of the country would be very decidedly increased. For instance, in the case of hereditary ptosis described in Chapter XII and illustrated in Figs. 124 and 125, I feel very sure that, by this timely operation, I have changed the course of this patient's life from certain invalidism to perfect health. It is in this class of young people that I believe the principal fields of the surgical treatment of ptosis will be. Waugh's experience in operating on over a hundred children leads him to hope that these defects may be discovered and diagnosed much earlier and that these children may be operated upon as we now operate upon the cleft palate. I can see many difficulties in this utopian hope, but cases such as I have described are coming regularly to every surgeon



FIG. 203.—NORMAL SMALL INTESTINE OF SUBJECT OF ASTHENIC HABITUS. (Mills.)

Compare with following photo. On the whole position is low, loops show tendency to massing, especially true of ileum. Tonus poor and motility slowest of any type. Differentiation of jejunum and ileum usually more marked in this type.

who has a large practice and can be relieved by the means we have suggested if they are recognized by the surgeon.

In class two, I would place a group of long standing invalids who have not been relieved by proper medical treatment and who have painful or obstructive symptoms located particularly on the right side either in the neighborhood of the cecum and ascending colon or the gall-bladder and duodenum, and who, when the abdomen is opened, show no organic disease but rather a right-sided ptosis with the pathology described in previous chapters.

There are cases of midline ptosis in which there has been development of acquired membranes or bands between the prolapsed transverse colon and the ascending or descending colon, or both, which makes the ptosis permanent; or in which the omentum has become adherent to the lower abdominal or

pelvic organs or to an operative incision by which the ptosis is made permanent. In such cases the bands are cut, the colon is restored, the omentum sutured to the parietal peritoneum, after which forced-feeding and fattening, as in all other forms of ptosis, becomes the most important feature. There are, of course, other indications which each surgeon must determine for himself.

The most important secondary question which the reader might ask would be, What does the X-ray show us that will help us to determine whether a case is or is not surgical?

In answer to this question, I must say that while I consider the X-ray of supreme importance in connection with this class of cases, in the way of



FIG. 204.—PHOTO OF WOMAN OF ASTHENIC HABITUS. (Mills.)

Compare with type of small intestine shown in preceding figure. Characterized by general frailty, light body weight, very long gracile shallow thorax with acute intercostal angle. Short abdomen longitudinally, wide pelvis.

locating and determining the mobility and motility of the various parts of the gastro-intestinal tract, I think it would be very dangerous in our present state of knowledge to put down in print any X-ray findings which should be an absolute indication for surgical interventions. I am of the opinion that this is no department of surgery for the "rule-of-thumb" surgeon who would be likely to treat these cases surgically simply because the organs happened to occupy a certain position. It is a branch of work which should be taken up and carefully studied and practiced by surgeons who are trained in broad surgical principles. It is probable that the next great field for advanced X-ray work is going to be along the line of the cases discussed in this book. I think it is probable that we will be able to determine by roëntgenology the amount of intra-abdominal and intravisceral pressure, the motility of the gastro-

intestinal tract and many other things which will enable the broad-minded surgeon to make a sound estimate of his case and determine the proper course of action, provided he has availed himself of a proper knowledge of the fundamental principles involved in the entire ptosis question.

Some very illuminating pictures along this line have recently been published by R. Walter Mills¹ of St. Louis which are published in a paper entitled "X-ray evidence of Abdominal Small Intestinal States Embodying an Hypothesis of the Transmission of Gastro-intestinal Tension." These pictures, reproduced in Figs. 201, 202, 203, 204 and 205, speak for themselves. I think nothing has been published which adds more strength to our theory



FIG. 205.—EXTREME DEGREE OF HYPERTONICITY OF SMALL INTESTINE. (Mills.)

This is seen characteristically in subjects of markedly asthenic habitus and a high degree of tonicity, common as to visceral tonicity in general.

expressed in previous chapters as to the importance of intra-abdominal and intravisceral pressure and its regulation by the deposition of fat within the abdominal wall than do these pictures. It might be said by the skeptical that these simply represent types of individuals. But we have had the opportunity to try out a sufficiently large number of cases before and after fattening to prove to our complete satisfaction that these differences in the X-ray appearance of the gastro-intestinal tract may be accounted for in many instances entirely by the amount of intra-abdominal fat and the strength of the abdominal wall. By these pictures of Mills, the loops of ileum and jejunum may be differentiated to a very large extent. In Fig. 206, a very extraordinary

¹ *Am. Journ. Roentgenol.*, April, 1922, No. 4, 9.

picture is shown. The loops of ileum not only show the barium but show gas distention, with clear outlines of the loops of the small intestine.

CONCLUSION

Gastro-enteroptosis is a subject which deserves much more thoughtful consideration from the thinking members of the profession than it has received. There is a real, physical basis for it and many of the pains and discomforts of individuals so afflicted are as real as any other ills. Being a mechanical and physical condition, largely, mechanical and physical measures



FIG. 206.—EXTREME HYPOTONICITY OF SMALL INTESTINE AS SEEN IN MARKEDLY ASTHENIC AND DEBILITATED PERSONS. (Mills.)

Gas-filled loops probably result of hypotonicity, not necessarily pathological but do not express admirable conditions. Small intestine as here shown not distinguishable from that of pathological causation except through consideration of other factors, especially habitus.

are essential to its proper treatment. Most of the individuals so afflicted are subnormal physically. They can be made more nearly normal and most of their ills can be relieved by mechanical measures applied by physical and dietary training. There is a certain proportion of the cases in which it is necessary to use surgical measures in order to get results. It is probable that my estimate above is ultraconservative. While I have been engaged in general surgery for approximately twenty-five years and have had what may be termed a relatively broad general surgical experience, I unhesitatingly state that there is no part of my surgical work which has been more satisfactory than that pertaining to the ptosis question.

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